Instruction Manual

Model

1920A

Frequency Counter

FLUKE®

JOHN FLUKE mfg. co., inc.

SEATTLE, WASHINGTON

FLUKE®

Instruction Manual

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1920A

Frequency Counter

P/N 400101

11/77

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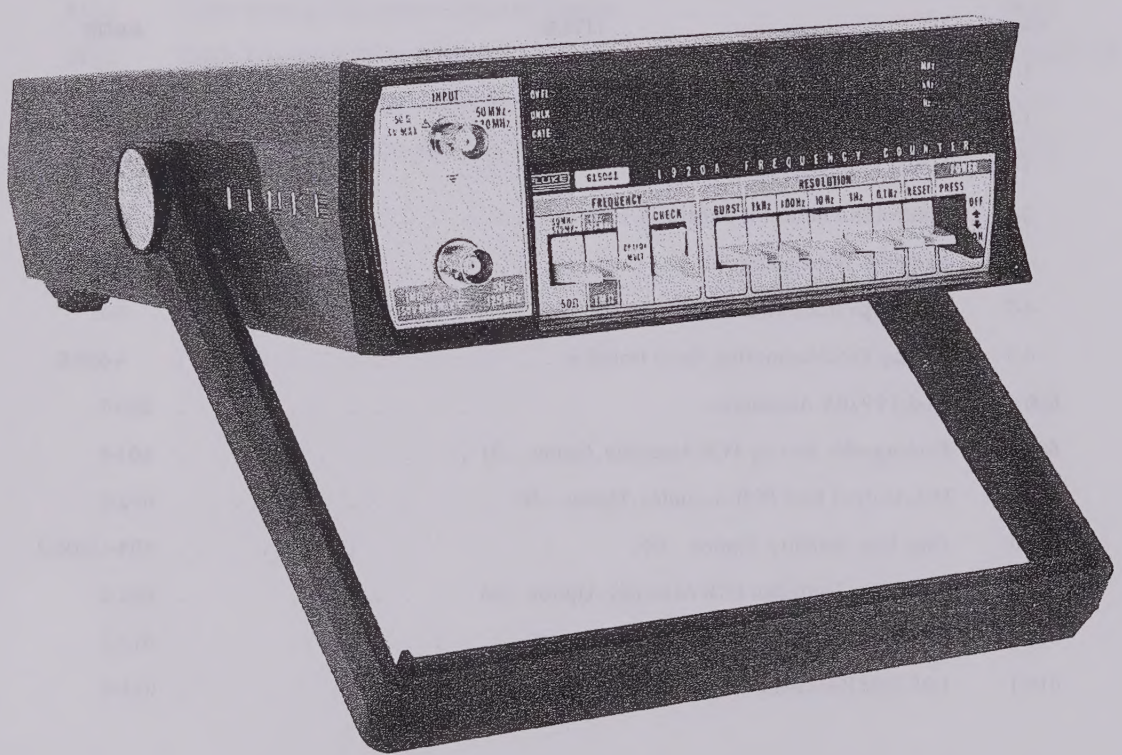


Model 1920A Frequency Counter

Section 1
Introduction & Specifications

1-1. INTRODUCTION

1-2. The Fluke Model 1920A Digital Counter is a 5 Hz to 520 MHz (to 1 GHz or 1.25 GHz, optional) counter designed primarily for telecommunications applications. The unit is compact and lightweight making it fully portable and suitable for field use. An optional battery-operated version of the counter permits use at remote or mobile installations where AC line power is unavailable.

1-3. The display is nine digits, light-emitting-diode (LED) type with leading-zero suppression and automatic decimal point positioning. Display resolution is front-panel selectable at 1 kHz, 100 Hz, 10 Hz, 1 Hz or 0.1 Hz. Annunciators are provided to indicate the measurement unit (i.e. MHz, kHz, or Hz) and also overflow when the capacity of the display is exceeded. All displayed measurement data is provided by an optional Data Output Unit (DOU, Option -02).

1-4. Input sensitivity for the 1920A is better than 15 mV rms and AGC is incorporated to provide stable operation. Extremely low-level signals which cannot be reliably measured, fall below the AGC threshold and are ignored by the counting circuitry. A "burst" mode is provided to permit the measurement of keyed RF signals having a duration of two milliseconds or greater. The display is automatically held at zero if the RF burst is of shorter duration than the selected gate time (resolution).

1-5. The 1920A also incorporates an optional high-resolution mode (Option–06) to permit the measurement of low frequency signals, such as signalling tones, while using conveniently short gate times. In this mode, input signals in the range of 10 Hz to 10 kHz are multiplied by a factor of 1000 allowing the use of shorter gate times for better resolution.

1-6. A self-check mode of speration is also provided to verify proper overall performance of the digital circuitry and the display of the unit prior to use.

1-7. Several options are available with the Model 1920A. Each is listed by option number in Table 1-1. Accessories are listed and described in Table 2-1. Desired options must be specified at time of purchase. A detailed description of each option is included in Section 6, Options and Accessories.

Table 1-1. Available Options

OPTION	NAME	INSTALLATION	
		FACTORY	CUSTOMER
–01	Battery Pack*	YES	YES
–02	Digital Output Unit*	YES	YES
–04	Superior Tcxo	YES	NO
–06	Multiplier, Resolution	YES	NO
–13	1 GHz Prescaler	YES	NO
–14	1.25 GHz Prescaler	YES	NO

*Kits Available

Table 1-2. 1920A Accessories

ACCESSORY MODEL NO.	DESCRIPTION	PART NO.
A53	Antenna, extendable whip.	382762
C89	Case, Carrying	446803
MOO-200-625	Rackmount kit	390468
2010A-7023	Printer Interface kit	410472

1-8. Power requirements for the 1920A are 100, 115 or 230 volts at 50 to 400 Hz for the line-powered version. Model 1920A-01, is equipped with rechargeable nickel-cadmium batteries which provide a minimum of three hours (1.5 hrs. with –13 or –14 Option installed) of operation. The battery-powered unit also operates from the AC power line, and at the same voltages as the line-powered instrument.

1-9. The standard time base TCXO has an aging rate of $\pm 3 \times 10^{-7}$/month and $\pm 2 \times 10^{-6}$, 0°C to 50°C. An optional TCXO (Option–04) provides an aging rate of $\pm 3 \times 10^{-7}$/month and $\pm 5 \times 10^{-7}$, 0°C to 50°C. In addition, an external time base signal of 1 MHz, 5 MHz or 10 MHz may be connected via a rear-panel BNC connector.

1-10. SPECIFICATIONS

1-11. Pertinent specifications for Model 1920A are listed below (See Table 1-3). Several options and accessories are available for use with the 1920A. Physical dimensions of the unit are shown in Figure 1-1.

Table 1-3. Model 1920A Specifications

FREQUENCY MEASUREMENTS

RANGE:
- Direct ..... 5 Hz to 125 MHz with AGC
- Prescaled ..... 50 MHz to 520 MHz with AGC

BURST MODE:
- Frequency Range ..... 1 MHz – 520 MHz
- Burst Duration ..... 25ms plus gate time selected

GATE TIME:
- Direct 1ms, 10ms, 0.1s, 1.0s, 10s
- Prescaled ..... 4ms, 40ms, 0.4s, 4.04s, 40s (520 MHz)

INPUT CHARACTERISTIC

SENSITIVITY:
- Direct ..... 15 mV up to 100 MHz decreasing to 25 mV at 125 MHz
- Prescaled ..... 15 mV to 520 and 1000 MHz

OVERLOAD:
- Direct ..... 150 V rms up to 1 kHz decreasing to 5V rms at 125 MHz
- Prescaled ..... 5 Vrms, fuse protected

TIME BASE STABILITY

	Standard	–04 Option
FREQUENCY	10.0 MHz	10.0 MHz
AGING RATE (PER MONTH)	$< \pm 3 \times 10^{-7}$	$< \pm 3 \times 10^{-7}$
TEMPERATURE STABILITY		
0°C to 50°C	$< \pm 2 \times 10^{-6}$	$< \pm 5 \times 10^{-7}$
20°C to 30°C	$\pm 5 \times 10^{-7}$ typ	$\pm 2 \times 10^{-7}$ typ
LINE VOLTAGE		
(±10% change)	$< \pm 1 \times 10^{-7}$	$< \pm 5 \times 10^{-8}$

Table 1-3. 1920A Specifications (Cont)

EXTERNAL TIME BASE INPUT

FREQUENCY REQUIRED ..... MHz, 5 MHz, or 10 MHz
(Wired for 10 MHz at Factory)

SENSIVITY ..... 100 m Vrms

IMPEDANCE ..... 2kΩ, 40 pF

INPUT IMPEDANCE

DIRECT 1MΩ/30pF

PRESCALED ..... 50Ω, VSWR 2.5: 1 max

BURST MEASUREMENT ..... Measures frequency of RF burst is approximately 2.0ms. This allows for signal settling. Display is automatically reset to zero if burst width is less than the gate time selected.

GENERAL

DISPLAY ..... 9 digits LED, leading zero suppression time between successive measurements is 200 ins, plus gate time.

ANNUNCIATION (INDICATOR LED's) ..... OVFL (Overflow) MHz
UNLK (Unlock) kHz
GATE Hz

OPERATING TEMPERATURE ..... 0°C to +50°C (operating)
0°C to +40°C (during charging with option –01)
–40°C to +60°C (storage)

POWER REQUIREMENTS ..... 115/230V ±10%, 100V AC available
50 to 400 Hz; 15 watts typical.

LINE POWER FUSES ..... 1/4A AC-line version, 1/2 slo-blo battery version

DIMENSIONS/WEIGHT

Width (max)	228.6mm	(9.0 in.)
Height (max)	80.3mm	(3.16 in.)
Depth	335.3mm	(13.2 in.)
Weight (approx)	2.7 kg	(6 lbs.)
Weight with Batteries (approx)	3.6 kg	(8 lbs.)

BATTERY, RECHARGEABLE OPTION –01

NICKEL CADMIUM

Discharge Time ..... Min 3 hrs (1.5 with–13 or –14 Option installed) after full charge time.

Charge Time ..... 14 hrs (unit not turned on) 56 hrs (unit turned on.)

NOTE: Batteries should be fully discharged and recharged occasionally to maintain good long term usefulness.

Table 1-3. 1920A Specifications (Cont)

DATA OUTPUT OPTION–02

8-4-2-1 BCD output from each digit, plus encoded decimal point and units annunciation information. All outputs are CMOS Low Power TTL compatilbe, "HIGH" true. Print command is provided.

SUPERIOR TCXO, OPTION –04

FREQUENCY	10 MHz
AGING RATE (per month)	$< \pm 3 \times 10^{-7}$
TEMPERATURE STABILITY	
0 – 50°C	$< \pm 5 \times 10^{-7}$
20 – 30°C	$\pm 2 \times 10^{-7}$ typ
LINE VOLTAGE	
(±10% change)	$< \pm 5 \times 10^{-8}$

RESOLUTION MULTIPLIER, OPTION –06

FREQUENCY OPERATING RANGE	10 Hz – 10 kHz
GATE TIME	1 ms (1 Hz resolution) 10 ms (0.1 Hz resolution) 100 ms (.01 Hz resolution) 1s (.001 Hz resolution) 10s (.0001 Hz resolution)

1 GHz PRESCALER, OPTION –13

FREQUENCY RANGE	50 MHz to 1 GHz
INPUT IMPEDANCE	50Ω VSWR 2.5: 1 max
OVERLOAD	5V, fuse protected
GATE TIMES	8 ms, 80 ms, 0.8s, 80s

1.25 GHz PRESCALER, OPTION –14

FREQUENCY RANGE	50 MHz to 1.25 GHz
INPUT IMPEDANCE	50Ω VSWR 2.5: 1 max
OVERLOAD	5V, fuse protected
GATE TIMES	8 ms, 80 ms, 0.8s, 80s

Section 2
Operating Instructions

2-1. INTRODUCTION

2-2. This section contains operating information for the Model 1920A. The contents of this section should be read before operating the counter. Should any difficulties arise during operation of this instrument, please contact your nearest John Fluke Sales Representative, the John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, Wash. 98043, Telephone (206) 774-2211. A list of Sales Representatives is given in Section 7.

2-3. SHIPPING INFORMATION

2-4. The Model 1920A is packaged and shipped in a protective container. Upon receipt of the equipment, a thorough inspection should be made to reveal any possible shipping damage.

2-5. If reshipment of the equipment is necessary, the original container should be used. If the original container is not available a new container can be obtained from the John Fluke Mfg. Co., Inc. Please reference the equipment model number when requesting a new shipping container.

2-6. INPUT POWER

2-7. Both the line-powered and battery-powered versions of the Model 1920A can operate from either a 115V or 230V ac power line. Before connecting the power line, ensure that the line power selection switch is in the position which corresponds to the power line voltage. The power selection switch is located on the Main PCB; refer to Section 4 for access instructions.

2-8. RACK INSTALLATION

2-9. The Model 1920A may be center-mounted in a standard 19-inch rack when supplied with the appropriate rack mounting kit. Instructions for installing units in the rack mount are supplied with the rack mounting kit. The center rack mounting kit is Model No. MOO-200-625.

2-12. OPERATING FEATURES

2-13. The location and function of all controls, indicators and connectors are shown in Figure 2-1 and described in Table 2-1.

2-14. OPERATING NOTES

2-15. The following paragraphs describe various conditions which should be considered for operating the 1920A.

2-16. AC Line Connection

2-17. The rear-panel, three-prong, U-ground connector permits the 1920A to be connected to either 100, 115 or 230V ac, 50 to 400 Hz line power. The offset prong on this connector is connected to the 1920A chassis and should be connected, via the power cord, to a high quality earth ground.

2-18. OPERATION

2-19. Turn-On Procedures

2-20. Use of the following procedure is suggested for initial turn-on of the 1920A. With reference to the previous paragraphs turn on the 1920A as follows:

1. Install available options as required.
2. Connect the 1920A to line power (see paragraph 2-17).
3. Press ON/OFF Power switch.

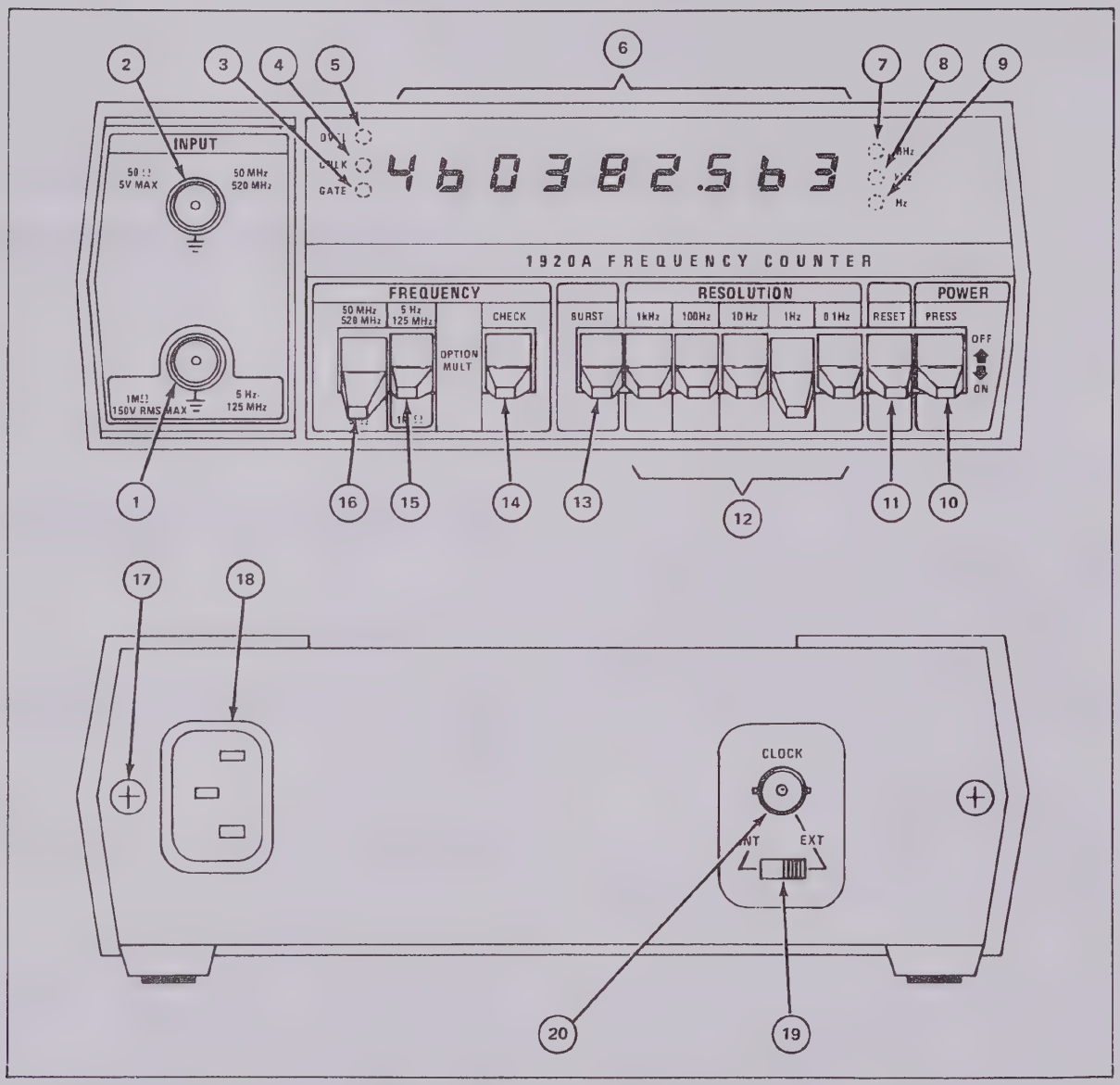


Figure 2-1. Control and Indicator Locations

Table 2-1. Control and Indicator Functions (Cont)

ITEM NO.	NAME	FUNCTION
1	5 Hz – 125 MHz 1 MΩ BNC connector	Provides connection to the direct (non-prescaled input of the counter for signals in the range of 5 Hz to 125 MHz.
2	50 MHz – 520 MHz 50Ω BNC connector	Provides connection to the prescaled input of the counter for signals in the range of 50 MHz to 520 MHz on the standard unit (50 MHz to 1 GHz and 50 MHz to 1.25 GHz are available with Options –13 and –14 respectively).

Table 2-1. Control and Indicator Functions

3	Gate Lamp	Lights to indicate a measurement is being made.
4	UNLK Lamp (Option –06), (UNLOCK)	Part of Option–06, Lights when the x1000 frequency multiplier (high resolution) function is selected and the frequency multiplier has not yet achieved phase lock-up, giving an ambiguous display.
5	OVFL Lamp, (OVERFLOW)	Lights to indicate that the display capacity has been exceeded due to selection of fine resolution (long gate time).
6	Display LED's	Display consists of nine digits. Leading zeros are suppressed.
7	MHz Lamp	Lights to indicate display is reading MHz.
8	kHz Lamp	Lights to indicate display is reading kHz.
9	Hz Lamp	Lights to indicate display is reading Hz.
10	POWER Switch	A push-push switch to energize the counter.
11	RESET Switch	A piano-key switch, when pressed, resets the counter to zero and initiates another measurement. When pressed with CHECK function selected, causes all correctly operating display segments to illuminate.
12	RESOLUTION Switches	A series of five switches to select the desired measurement resolution. For example, if 10 Hz Resolution is selected, the least significant digit (LSD) represents 10 Hz.
13	BURST Switch	A piano-key switch to select the Burst mode of operation which measures keyed RF bursts.
14	CHECK Switch	A piano-key switch to select the Self-Check mode of operation.
15	5 Hz–125 MHz 1 MΩ Switch	A piano-key switch to select the direct (non-prescaled) input for measurement of signals in the range of 5 Hz to 125 MHz.
16	50 MHz – 520 MHz 50Ω Switch (50 MHz–1 GHz or 50 MHz – 1.25 GHz)	A piano-key switch to select the prescaled input for measurement of signals in the range of 50 MHz to 520 MHz (50 MHz to 1 GHz, Option–13 or 1.25 GHz, Option–14.
17	Retaining Screw	Philips-head screw attaching case to instrument chassis.
18	Power Connector	Provides connection through line cord to AC power line.
19	INT/EXT Switch	Slide switch to select either the internal timebase or an external timebase signal applied to the CLOCK Connector.
20	CLOCK Connector	Provides for connection of an external timebase signal of 1 MHz, 5 MHz or 10 MHz (depending on internal jumper configuration) when the INT/EXT switch (see item 21) is placed in the EXT position.

2-21. Turn-Off Procedure

2-22. The turn-off procedure consists of setting the ON/OFF Power Switch to the OFF position, by first pressing down and then releasing.

2-23. Operating Functions

2-24. The following paragraphs describe the self-check, frequency measurement, direct mode, prescaler mode, burst mode, external timebase, and give procedures necessary to operate the 1920A for each.

2-25. SELF-CHECK MODE

NOTE

The following procedure assumes a 10 MHz timebase. Substitute appropriate readings if a 1 MHz or 5 MHz external timebase is being used.

2-26. The self-check mode provides a means of verifying proper overall operation of the counter, excluding the direct input amplifier, the prescaled input amplifier and the high resolution multiplier. To self-check the unit, proceed as follows:

1. Press the Power switch to the ON position.
2. Press the CHECK switch.
3. Press the RESET switch. All display segments should light. The display should read 888888888.
4. Press the 1 kHz RESOLUTION switch. The display should read 10.000 MHz $\pm$ 1 digit.
5. Press the 100 Hz RESOLUTION switch. The display should read 10.0000 MHz $\pm$ 1 digit.
6. Press the 10 Hz RESOLUTION switch. The display should read 10000.00 kHz $\pm$ 1 digit.
7. Press the 1 Hz RESOLUTION switch. The display should read 10000.000 kHz $\pm$ 1 digit.
8. Press the 0.1 Hz RESOLUTION switch. The display should read 10000.0000 kHz $\pm$ 1 digit.

2-27. FREQUENCY MEASUREMENTS

2-28. Signals to be measured by the Model 1920A are applied to either one of two BNC input connectors mounted on the left side of the front panel. The direct input (lower connector) accepts signals in the range of 5 Hz to 125 MHz. The prescaled input (upper connector) accepts signals in the range of 50 MHz to 520 MHz. The input impedance of the direct input is 1 Megohm shunted by less than 30 pF, while the prescaled input is 50 ohms.

2-29. Direct Mode (Color Coded Blue)

2-30. The 5 Hz to 125 MHz input is used in the direct measurement mode. This input is protected from overload to withstand inputs as high as 150 Volts rms at frequencies below 1 kHz without damage. Overload capability decreases from 150 Volts rms at 1 kHz to 5 Volts rms at 125 MHz.

2-31. To make frequency measurements in the direct mode, proceed as follows:

1. Connect the input signal to the lower front panel BNC connector.
2. Press the 5 Hz - 125 MHz switch.
3. Select the desired resolution, read the measurements on the display and note the unit of measurement (i.e., MHz, kHz).

2-32. Prescaled Mode (Color Coded Yellow)

2-33. The 50 MHz to 520 MHz input is used in the prescaled measurement mode. This input is protected from overload to withstand inputs as high as five volts rms without damage. (Overload protection is provided by a PCB mounted 2/10A fuse).

2-34. To make frequency measurements in the prescaled mode, proceed as follows:

1. Connect the input signal to the upper front panel BNC connector.
2. Press the 50 MHz to 520 MHz switch.
3. Select the desired resolution, read the measurement on the display and note the unit of measurement (i.e. MHz or kHz).

2-35. Burst Mode

2-36. The function of the burst mode is to measure the frequency of keyed RF signals having a duration of 31 milliseconds or longer. RF bursts must be longer than the gate time selected in order to achieve an accurate measurement. When using the DIRECT input the length of the burst must be at least 30 ms longer than the gate time selected, i.e., 31 ms for 1 ms gate time.

2-37. When using the PRESCALER input, multiply the gate time selected by the prescaler division factor: If the 1 ms gate time is selected the real gate time will be 4 ms for the 520 MHz Prescaler. (Add the 30 ms to these corrected gate times for the minimum burst length when using the prescalers.)

NOTE

Modification to lengthen the burst requirements to 30 ms has been added to the counter. This 30 ms delay was added to insure the count would be of the desired signal frequency and not turn-on transients.

2-38. To make measurements of keyed RF bursts, proceed as follows:

1. Connect the input signal to the appropriate front panel BNC connector (i.e. direct or prescaled input) and press corresponding FREQUENCY selection switch.

2. Press the BURST switch.

3. Select the desired resolution and read the measurement on the display. If the display reads zero, yet the GATE lamp flashes (indicating that bursts are present and measurements are being attempted), the Burst input is of shorter duration than the gate time must be selected. (Approximately 1 ms longer than selected measurable intervals).

2-39. CHANGING THE EXT TIME BASE FREQ

2-40. The Model 1920A permits the use of an external time base in substitution for the internal time base. The external time base may be 1, 5 or 10 MHz, in the range of 100 mV rms to 20V rms. Input impedance is 2,000 ohms (1000 ohms after clipping for signals above 500 mV rms). Connection is made via the rear panel BNC connector and the INT/EXT slide switch is placed in the EXT position. It may be necessary to make a jumper modification on the main PCB assembly in order to accommodate the particular external reference frequency being used. For instance, the Model 1920A is factory-jumpered for a 10 MHz external reference signal, and must be modified if a 1 MHz or 5 MHz signal is to be used.

2-41. To modify the main PCB assembly for the application of a 1 MHz or 5 MHz external reference signal, proceed as follows:

1. Remove the unit from the case by loosening the two retaining screws on the rear of the case.

2. Locate the reference jumper pads on the main PCB. (If so equipped, remove the DOU PCB assembly or the Battery PCB assembly and swing away to the side).

3. Using a suitable cutting tool, such as an X-acto, Inc. knife, sever the conductive land between the REF and 10 pads.

4. Using a piece of 22 AWG wire insert and solder a jumper between the REF pad and the 1 pad for a 1 MHz reference, or a 5 pad for a 5 MHz reference.

Section 3
Theory of Operation

3-1. INTRODUCTION

3-2. This section of the manual contains an overall functional description of the Model 1920A Frequency Counter. Simplified circuit description is also provided for easier circuit understanding. The individual sections of the simplified schematic diagrams are presented in more detail. It is recommended that this section be thoroughly read and understood before an attempt is made to service your instrument.

3-3. OVERALL FUNCTIONAL DESCRIPTION

3-4. Generally, the frequency of any signal is measured by counting the number of cycles of the unknown signal for a known length of time, referred to as the gate time. Gate time is usually equal to seconds at some power of ten, i.e., one millisecond, ten milliseconds, etc. The longer the gate time the greater the measurement resolution. The accumulated count of the input signal cycles is then fed to the display section where it is observed by the operator.

3-5. As shown in Figure 3-1, the Model 1920A is comprised of a Direct Preamplifier, an optional X1000 Multiplier, a Main Gate, Decade Counters, a Digital Display, Program Control Logic, a TCXO and Time Base Dividers. The unknown signal is applied to either the Direct Preamplifier or the prescaler input where it is limited, amplified and shaped to a squarewave for application to one input of the main gate. If the signal is applied to the Prescaler, it is also divided by a factor of four (or by a factor of eight in the 1 GHz and 1.25 GHz prescalers) for application to the Main Gate. In the high-resolution mode, the input signal is routed through the X1000 Multiplier (–06 Option) before being applied to the main gate.

3-6. In order for the input signal to be applied to the decade counters, a Main Gate Enable signal is required at the input of the counters. The Main Gate Enable signal is derived from the 10 MHz output of the TCXO (or external reference) and the Time Base dividers. The 10 MHz time base dividers, where it is divided by a factor of 10^4, 10^5, 10^6, 10^7, and 10^8, depending upon which range (degree of resolution) is selected. If the 1 kHz resolution is selected, the TCXO output is divided by a factor of 10^4 to yield a time base having a period of one millisecond. For a time base of ten milliseconds, a division fact of 10^5 is used, and so on.

3-7. The above division factors apply only when the Direct Preamplifier is used. When using the prescaler input, additional time base division is required to achieve longer gate time since the input signal undergoes some division in the prescaler. In the 520 MHz Prescaler, the additional division is by a factor of four.

3-8. The divided time base signal is applied to the Main Gate and enables the signal under measurement to pass through to the nine series-connected decade counters for one full period of the divided time base. The decade counters continue to accumulate the gated pulses from the input signal as long as the main gate enable signal is present, i.e. for the period of the time base. At the end of the time base period, the Main Gate is inhibited and the counters no longer receive input pulses. At this time, the program control logic issues a memory update command to the display memory, causing the contents of the nine decade counters to be stored in nine memory units until the next memory update command occurs.

3-9. There are nine decade counters, nine four-bit memory units and nine display light-emitting diodes (LED's). However, the contents of only one memory unit (one digit of measurement date) is displayed on its corresponding LED at any given time. A display multiplexer sequentially places the contents of each memory unit on a measurement data

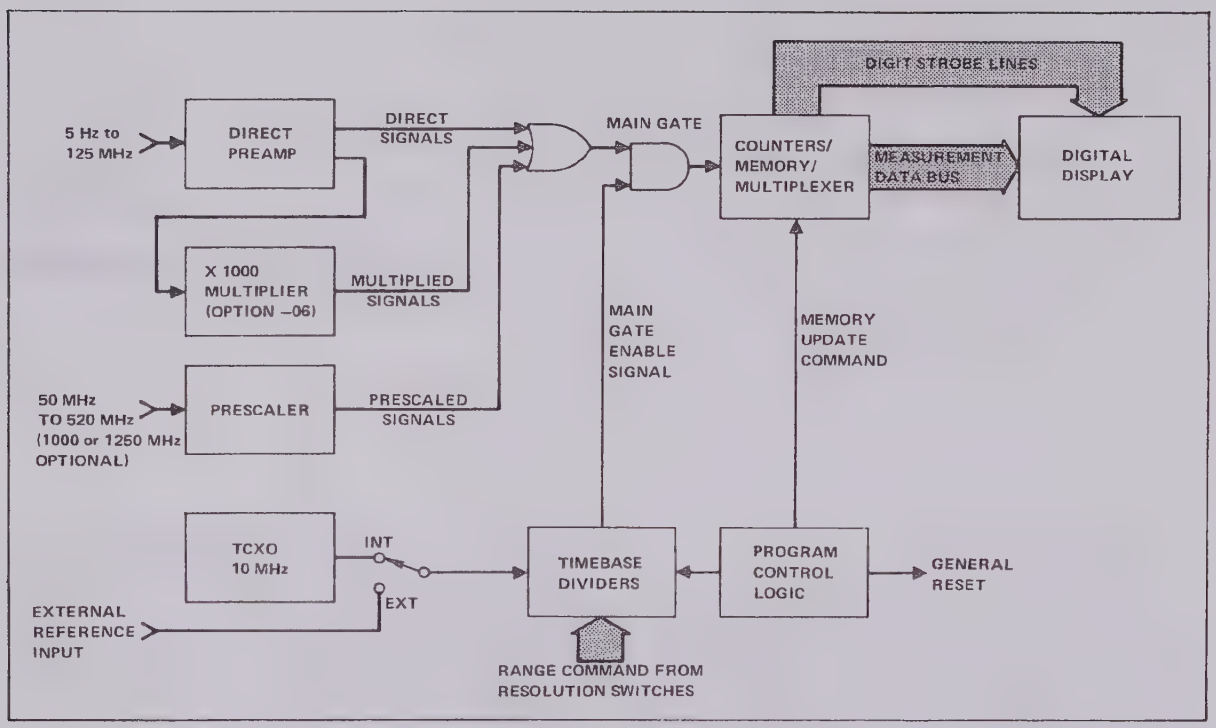


Figure 3-1. Model 1920A Overall Block Diagram

bus for a period of approximately 90 microseconds. The measurement data bus is commonly connected to all digits (LED's) in the display. However, only that digit which corresponds to the memory unit being gated is enabled by means of a strobe line. As the next memory unit is gated onto the measurement data bus, the next digit is strobed to display that data. As each memory unit is gated, the corresponding LED is strobed to display the data placed on the measurement data bus, resulting in a scanning action of the display. By sequencing through the display memory and lighting each LED for only 9% of the full strobe cycle, LED power consumption is minimized.

3-10. While the last measurement is being displayed (LSD first), the program control logic initiates the next measurement by generating a general reset command, to initialize various elements of the control logic. The general reset command is also used to reset the nine decade counters back to zero in preparation for the next measurement.

3-11. SIMPLIFIED CIRCUIT DESCRIPTION

3-12. Direct Preamplifier

3-13. The main function of the Direct Preamplifier is to condition input signals prior to application to the main gate or the multiplier circuit. As shown in Figure 3-2, the 5 Hz to 125 MHz input signal is fed to a FET input buffer Q1, whose input is limited (protected by diodes CR1 and CR2.) The output of the buffer feeds the PIN attenuator diodes CR3 and CR4 and the broadband amplifier (Q2, Q3, Q4). The output of this amplifier feeds a series of three operational amplifiers (contained in a single package, U2). Each amplifier is equipped with a double ended input and output. A reference voltage line biases the first amplifier and the AGC amplifier U1C.

3-14. The first amplifier (U2B) operates in an open loop mode. U2A is provided with positive feedback via R41 and R42. This amplifier operates as a Schmitt trigger to provide fast rise-times for low frequency inputs prior to application to the digital circuits within the counter. The input level at which the Schmitt trigger circuit fires is controlled by R30, the trigger level control. The third amplifier operates in an open loop mode to isolate the Schmitt trigger from excessive loading by the following ECL stages.

3-15. The AGC circuit receives the outputs of U2B which are peak detected by CR7 and CR8, and applied to one input of U1C. The other input is connected to the reference voltage of U2B via CR9. The output of U1C feeds U1B and U1C. U1B operates as a switch whose trigger point is set by R11. The output of U1B goes to the counter's control logic to signal that the signal level is acceptable and to indicate start of BURST signals in BURST mode, when that mode is selected.

3-16. The output of AGC amplifier U1D feeds the attenuator diode CR3, while U1A inverts the output of U1D to

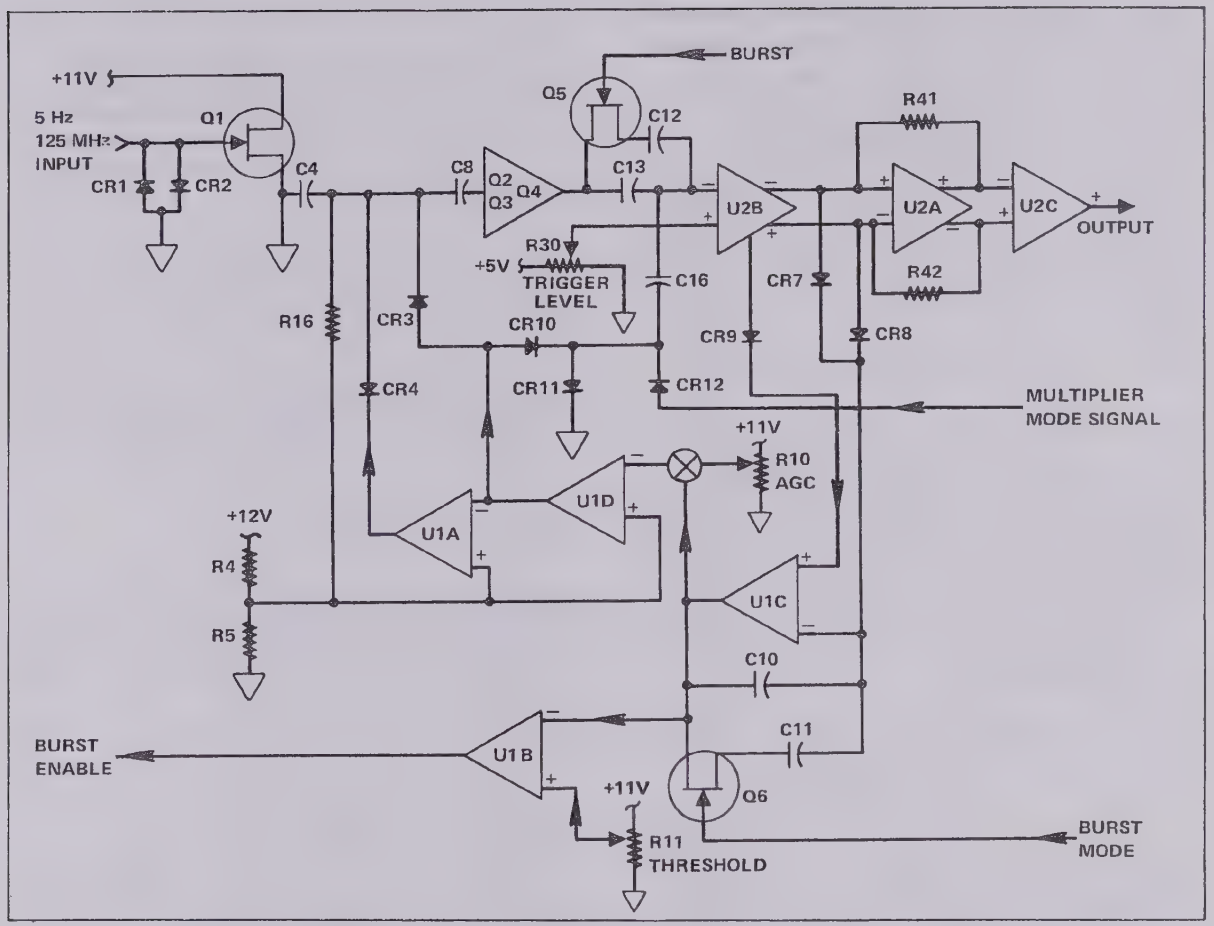


Figure 3-2. Direct Preamplifier Simplified Schematic

feed the complimentary diode CR4, ensuring that DC offset is not introduced into the amplifier chain. The output of U1D also feeds attenuator diode CR11 via CR10. When the counter is in RESOLUTION MULTIPLIER Mode, CR11 is also turned on to provide for low pass filtering through C16. When the counter is operated in the burst mode the AGC response is sped up by turning Q6 off. Low frequency response is also reduced by turning off Q5.

3-17. 520 MHz Prescaler

3-18. The main function of the prescaler is to reduce the frequency of the input signal to below 130 MHz for application to the main gate and decade counters. The prescaler also provides the necessary conditioning of the input signal to provide sufficient gain and the proper waveshaping. The frequency division factor for the 520 MHz prescaler is four.

3-19. As shown in Figure 3-3, the input signal is fed through an input protection fuse, F1, to the input of the first amplifier. The output of the second amplifier is applied to the input of a divider circuit (U3) which divides by a factor of four to reduce the input frequency to below 130 MHz. The prescaled signal, amplified by U1 and U2, divided and shaped by U3, is then fed to the PCB Main assembly for application to the main gate and decade counters.

3-20. The output of the second amplifier is fed to an AGC circuit where it is rectified by CR7, filtered by C11 and R12 and amplified by U4. The dc output of U4 is the AGC signal and controls the overall input signal level by means of CR5 and C4. Diodes CR4 and CR5 are positive intrinsic N-Layer (PIN type) diodes whose impedance varies with the amount of bias applied. When the AGC signal decreases due to a reduced input signal level, Q4, in turned-on full, increasing the impedance. Current flow will be reduced through CR5 causing an increase in impedance. This action results in a reduced shunting of the input signal of the input signal by CR5 and C4.

NOTE

The Prescaler, like the Direct Preamplifier, is energized only when that mode is selected. not selected, the front panel mode switch interrupts its power supply connection.

3-21. The AGC signal is also used to indicate the presence of an input signal to a Burst Enable circuit (part of the control logic) mounted on the Main pcb assembly. When an input is present, the AGC line goes positive to turn-on Q1 and turn-off Q4. The Burst Enable signal is zero volts to the burst enable circuit and the control logic to allow normal counter operation. If the input signal is interrupted, or reduced to below minimum acceptable amplitude, Q1 and Q4 change state to provide a positive (false) Burst Enable signal and also clamp the prescaler output to +5volts.

3-22. Main Gate and Decade Counters

3-23. The main gate is an integral part of the nine decade counters, as shown in Figure 3-4. The gating of the input signals from the direct preamplifier, prescaler, multiplier or time base oscillator to the Main Gate is accomplished by applying an enable signal to the J and K inputs of the first stage of the first decade counter. Since the input signals are applied to the clock input of the first stage, the J and K inputs must be True in order for the input signals to toggle the first stage, which in turn, toggles the subsequent stages.

NOTE

Seven of the nine decade counters, the display memory, the display multiplex and measurement data bus described in these paragraphs are contained in a single LSI device, (See Parts Lists) and are not separately replaceable for the purpose of repair.

3-24. The main gate is enabled by the application of the main gate enable signal. When enabled, the Main Gate (as part of the first Decade Counter) receives the input signal and on the count of ten, a carry pulse is issued to the succeeding decade counter. The carry output of each counter becomes the input to the succeeding counter. The carry output of the most significant digit decade counter is used to generate the overflow signal, which lights the OVFL indicator.

3-25. Display Memory

3-26. The function of the display memory, shown in Figure 3-4, is to store the BCD contents of the decade counters after the measurement has been made, so that the multiplexer has access to settled data at all-times. Without

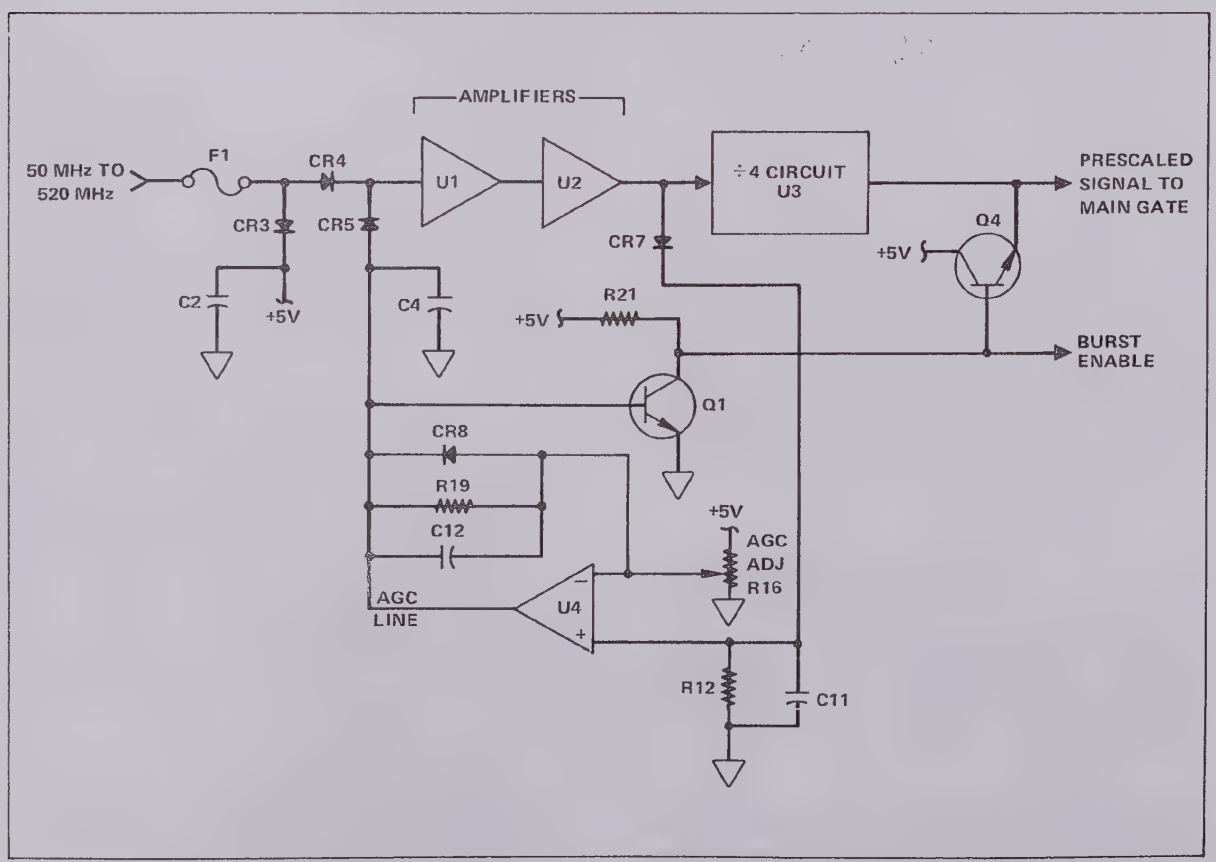


Figure 3-3. 520 MHz Prescaler Simplified Schematic Diagram

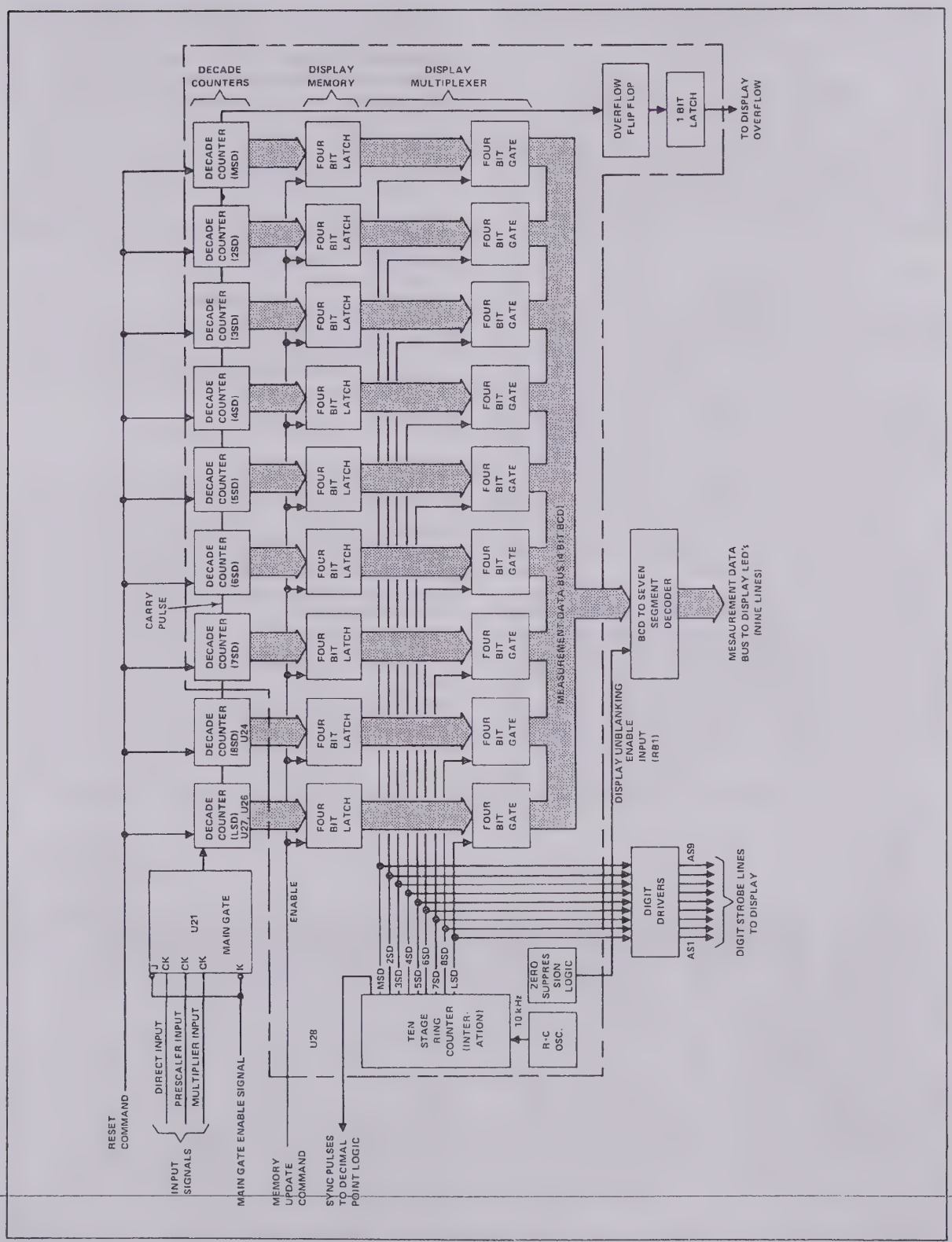


Figure 3-4. Decade Counters, Display Memory & Display Multiplexer Block Diagram

the display memory, the display would directly reflect the counting action of all the decade counters, making it difficult to observe the final measurement.

3-27. The display memory comprises a set of nine four-bit latches which accept their applied BCD inputs during the presence of a memory update command. The memory update command is generated by the control logic when it has determined that the contents of the decade counters are ready for display. (The control logic is described later in this section).

3-28. Display Multiplexer

3-29. The function of the display multiplexer is to sequentially gate each digit of measurement data from the outputs of the display memory onto a bus which is commonly connected to all display LED's. In conjunction, the display multiplexer also enables the corresponding LED at the same time its respective measurement data is placed on the bus. As shown in Figure 3-4 the Display multiplexer comprises a series of nine four-bit gating circuits, an oscillator drives the ten-stage ring counter through a complete cycle every millisecond. Each output is true for a period of 90 microseconds, providing a 10 microsecond guard period between each output.

3-30. Nine of the ring counter outputs are used to enable the nine four-bit gating circuits, and their corresponding display LED's. The tenth output is used to reset the zero suppression logic. As the ring counter progresses through its cycle, each of the gating circuits is sequentially enabled for a period of 90 microseconds to place its respective digit of measurement data on the measurement data bus for application to the display LED's. At the same time the digit of measurement data is placed on the bus, the ring counter output feeds the digit strobe line, via the corresponding LED's drivers, to enable the corresponding display LED. (Refer to figure3-4).

3-31. Prior to application to the display, the BCD measurement data is decoded to the seven-line format required by the display LED's. The digit strobe lines are fed through a series of drivers for application to the anodes (enable inputs) of the display LED's.

NOTE

The BCD-to-seven segment decoder is inhibited by zero suppression logic whenever non-significant leading zeros are placed on the measurement data.

3-32. Decimal Point Positioning

3-33. The position of the decimal point in the display is a function of the RESOLUTION switches and is determined by the coincidence of the digit strobe line and a signal on the decimal point bus shown in Figure 3-5. For example, if the 10 Hz RESOLUTION switch is pressed, then the SD2 strobe line is connected to the decimal point bus. Each time a pulse appears on the SD2 line, a pulse will appear on the decimal point bus. As a result, the 2SD LED receives a pulse on the anode enable input at the same time a pulse is present on the decimal point bus. Since the pulse is present on the decimal point bus only during the period of SD2, only the 2SD decimal point lights.

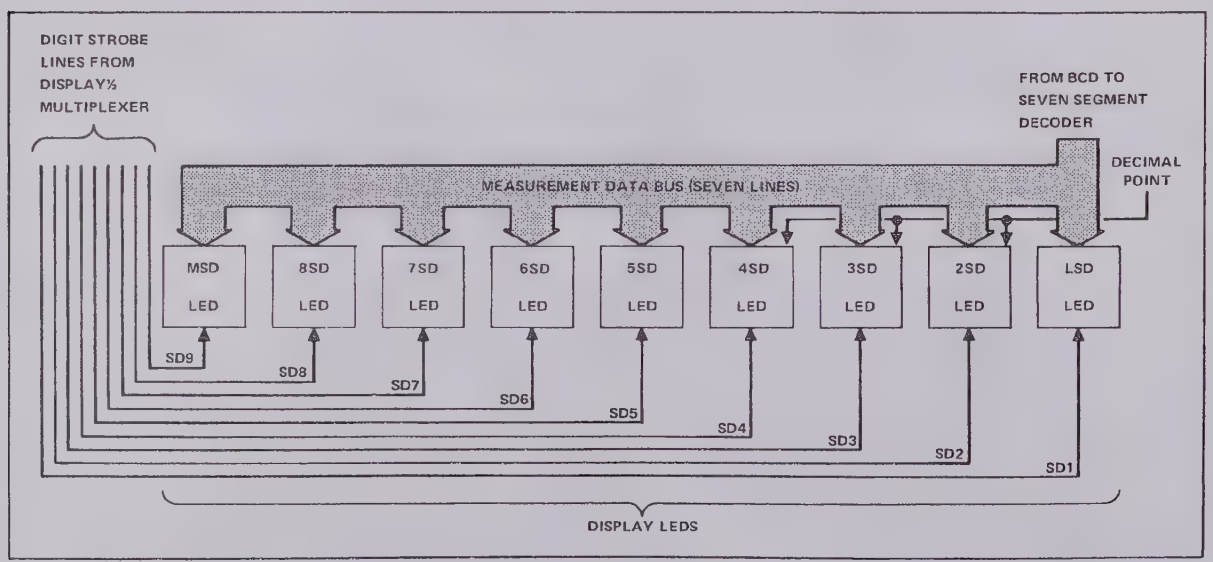


Figure 3-5. Decimal Point Positioning, Block Diagram

3-34. Time Base Oscillator

3-35. The time base oscillator provides the main gate reference frequency and is comprised of a Temperature Compensating Crystal Oscillator (TCXO), a conditioning amplifier and selectable dividers, as shown in Figure 3-6. The basic time base source may be the internal TCXO or an external source having a frequency of 1 MHz, 5 MHz or 10 MHz.

3-36. The programmable divider has three division ratios (1:1, 5:1 and 10:1) to permit the use of the three different external time base frequencies, and is programmed by means of jumpers. The output of the programmable divider is 1 MHz which is further divided if operation is in the prescale mode. For the 520 MHz prescaler, a division ratio of 4:1 is used. (For the optional 1 GHz and 1.25 GHz Prescalers, a division ratio of 8:1 is used).

3-37. Time Base Dividers

3-38. The function of the time base dividers, shown in Figure 3-7 is to divide the 1 MHz (250 kHz or 125 kHz in the prescale mode) time base signal by a selected power of ten to obtain the proper main gate enable signal. The time base dividers are contained within a single integrated circuit which receives division commands from the front panel RESOLUTION switches.

3-39. Control Logic/ Sequencer

3-40. The control logic, shown in Figure 3-7 controls the sequence of events which take place throughout the counter in order to make a measurement and display the result. The control logic sequences through the measurement cycle at a rate determined by a 50 Hz relaxation-type oscillator and the selected gate time (resolution). The measurement cycle consists of the following basic steps:

1. A general reset command (R) is issued to initialize the control logic and decade counters.

2. The main gate is enabled for a period of time which corresponds to the selected resolution. During this time, the decade counters accumulate the input pulses passed by the main gate. Also, the 50 Hz oscillator is inhibited during this time.

3. At the end of the Main Gate time, the Main Gate is inhibited and a memory update command is issued to load the display memory with the contents of the decade counters.

4. With the measurement data loaded into the display memory, the display multiplexer sequentially displays each digit of data the respective LED until the display memory is updated with the results of the succeeding measurement.

3-41. The following discussion describes the measurement cycle with reference to Figure 3-7. As a starting point, assume the sequencer (U2), which is basically a ten-stage ring counter, is at count state zero. State zero is a general reset ($\overline{R}$) command which is used to initialize the control logic and reset the decade counters to zero. The Sequencer advances to state one and presets (Divider Enable Flip-Flop) U8B which enables one input of the Divider Enable Gate (U7A) and one input of the Sequencer Inhibit Gate (U1C). Twenty milliseconds later, the 50 Hz oscillator (U19) advances the Sequencer to state two and clears the Burst Enable circuit (described later in this section).

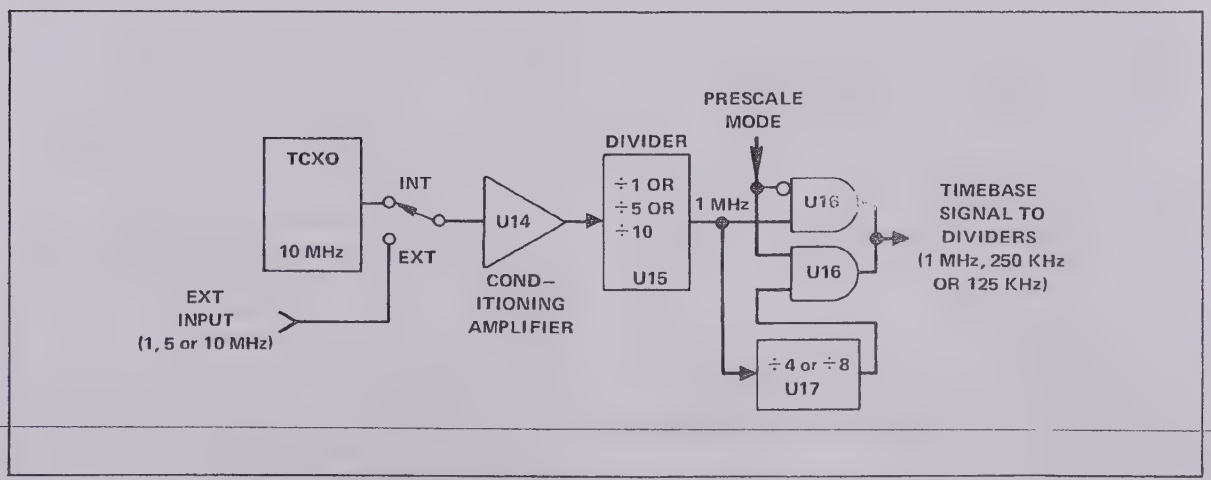


Figure 3-6. Time Base Circuit, Simplified Schematic

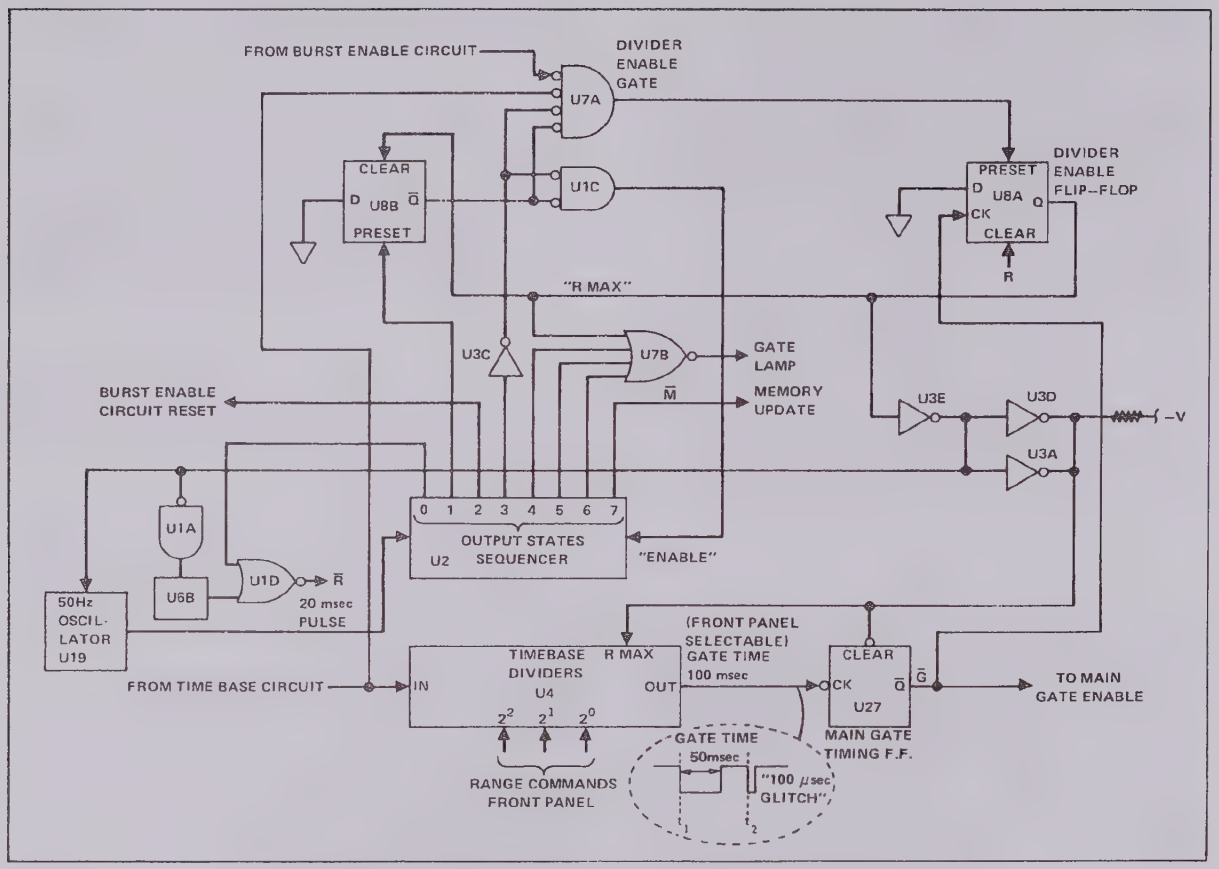


Figure 3-7. Control Logic/Sequencer Simplified Schematic

3-42. State three of the Sequencer enables the second input of the Sequencer Inhibit Gate (U1C) which prevents the sequence from advancing to state four. The state three output, also enables another input of the Divider Enable Gate (U7A). A third input to the gate is enabled by the action of the Burst Enable Circuit when the instrument is not in the burst mode, and the fourth input to the Divider Enable Gate is provided when the Time Base signal is at a low level. The output of U7A presets the Divider Enable Flip-Flop to produce the RMAX signal, which in turn, performs the following functions:

1. Enables the Time Base Divider.

2. Inhibits the 50 Hz oscillator (U19).

3. Clears U8B, which in turn, inhibits the Divider Enable Gate and removes the preset input from the Divider Enable Flip-Flop. U8B also removes the inhibit from the Sequencer, although the absence of the 50 Hz oscillator signal still prevents any Sequencer action.

4. Generates the GATE LAMP signal.

5. Removes the clear signal from the Main Gate Timing Flip-Flop (U27B).

3-43. For all states of the Sequencer, except state three the RMAX signal is high to reset and fold the Time Base Divider at maximum count (i.e. 99999.) and enable the 50 Hz oscillator. When the RMAX signal goes LOW ($\overline{RMAX}$), the Time Base Dividers are allowed to count and will wrap-around to zero upon receipt of the first pulse of Time Base Signal from the Time Base Oscillator. When the Time Base Dividers wrap-around to zero, a falling pulse-edge appears at the clock input of the Main Gate Timing Flip-Flop (U27). This negative-going transition (t_1 in Figure 3-7) sets the Main Gate Timing Flip-Flop and enables the Main Gate. During the time the Main Gate is enabled, the Decade Counters accumulate the input signal. Also during this time, pulses (Time Base Signal) being applied to its input. This action continues until the Time Base Divider (U4) reaches full count (i.e. 99999.) and wraps-around to zero again, to produce a second negative-going transition (t_2 in Figure 3-7) at the clock input of the Main Gate Timing Flip-Flop. At this time (t_2) the Main Gate Timing Flip-Flop is reset, the Main Gate is inhibited and no further input pulses are accumulated. The positive-going output of the Main Gate Timing

Flip-Flop also clears the Divider Enable Flip-Flop (U8A) since the preset input has been removed. With the Divider Enable Flip-Flop cleared, the RMAX signal is HIGH to reset and hold the Time Base Divider (U4) at full count.

3-44. Clearing the Divider Enable FF (U8A) also enables the 50 Hz oscillator signal and the Sequencer advances from state three to states four, five and six. Each of these states have a period of 20 milliseconds, and each prolong the GATE lamp signal for a cumulative total of 60 milliseconds plus the actual gate time of 1, 10, 100, 1000, or 10,000 milliseconds. This enables the operator to observe the GATE lamp when the shorter gate times are selected.

3-45. When the sequence advances to state seven, a memory update command is generated and fed to the display memory. The memory update command causes the display memory to be updated to the last measurement. The measurement is then multiplexed and displayed. States eight and nine are not used except for delay and the Sequencer proceeds to state zero to begin the next measurement cycle.

3-46. Burst Enable Circuit

3-47. The main function of the Burst Enable circuit is to inhibit and enable the previously described measurement cycle at the proper times for the purpose of measuring the frequency of keyed RF inputs to the counter. During normal counter operation (not using the Burst Mode), the front panel BURST switch places positive voltage on the Burst Flip-Flop (U6), shown in Figure 3-8, to hold it in the preset state. In the preset state, the Burst Flip-Flop maintains a low output to enable one input of the Divider Enable Gate allowing the measurement cycle to be controlled entirely by the Sequencer and Time Base Dividers.

3-48. In the Burst Mode, the preset voltage is removed from the Burst Flip-Flop, allowing it to be clocked and cleared. State two of the Sequencer clears the Burst Flip-Flop to inhibit the Divider Enable Gate. As a result, the Sequencer is halted at state 3 as in normal operation, but the Time Base Dividers are not yet allowed to count the Time Base Signal and clock the Main Gate Flip-Flop. When an input signal is received at the Direct Preamplifier or the Prescaler (depending on the selected mode) the Burst Flip-Flop is clocked to the set state and the Time Base Dividers are enabled. From this point, the measurement cycle proceeds in the manner described for normal operation until state three is again reached. The control logic will again halt at state three until a Burst Enable signal is received from one of the inputs.

NOTE

A nominal 30 msec. RC delay is added to the input of U6 making the minimum burst length 30 msec. . plus gate time. (Specified gate time to be multiplied by 4 for use with the 520 MHz prescaler and multiplied by 8 for use with the 1 GHZ-1.25 GHz prescalers.)

3-49. To prevent erroneous measurements, which would result if the RF burst under measurement were of shorter duration than the select gate time or dropped out during the measurement, a reset function is included to abort the measurement by zeroing the decade counters. As shown in Figure 3-8, the Burst Enable signal is applied to an AND gate along with the Divider Enable signal. If the Burst Enable drops (due to loss of input signal) before $\overline{RMAX}$ goes to HIGH at the end of the Main Gate time, a reset signal will be applied to all decade counters. This reset feature also operates in the normal mode to prevent erroneous readings when inputs of marginal levels are applied.

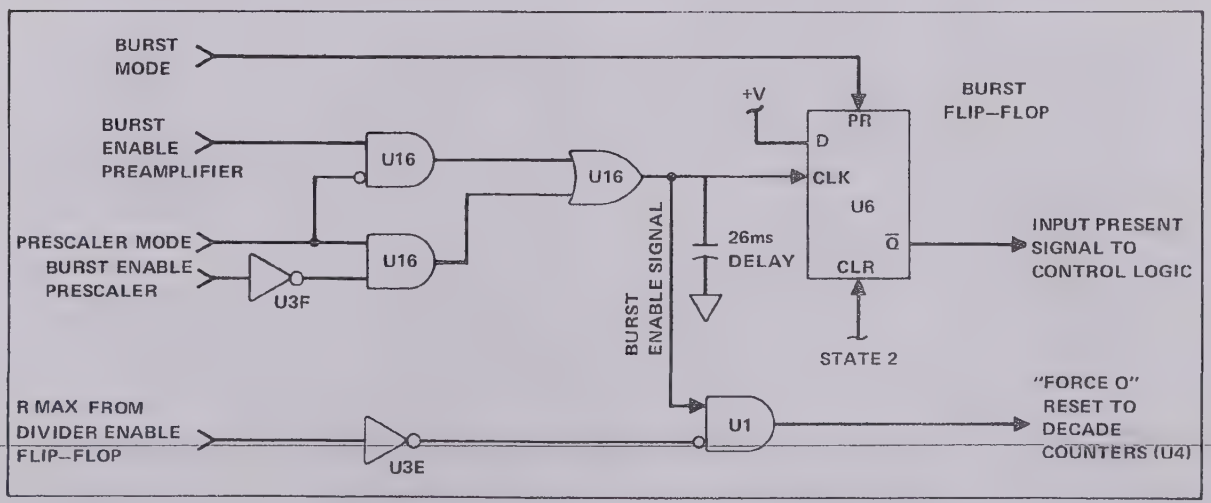
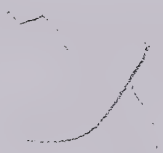


Figure 3-8. Burst Enable Circuit Diagram



Section 4
Maintenance

WARNING!

THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

4-1. INTRODUCTION

4-2. This section contains information concerning preventive and corrective maintenance for the Model 1920A. Equipment for performing maintenance tests and adjustments is listed in Table 4-1. If this equipment is not available, other equipment having equivalent specifications may be used.

4-3. SERVICE INFORMATION

4-4. Each instrument manufactured by the John Fluke Mfg. Co., Inc. is warranted for a period of one year upon delivery to the original purchaser. The WARRANTY is located at the front of the manual.

4-5. Factory authorized calibration and service for each Fluke product is available at various world-wide locations. A complete list of the authorized service centers is located in Section 7 of this manual. Shipping information is presented in Section 2. If requested, an estimate will be provided to the customer before any repair work is begun on instruments that are beyond the warranty period.

Table 4-1. Required Test Equipment

EQUIPMENT TYPE	REQUIRED BASIC SPECIFICATIONS	WHERE USED	RECOMMENDED MANUFACTURER
Quartz oscillator frequency standard with 10 MHz output	1×10^{-8} ppm stability	Time Base Oscillator Adjustment	HP 105A/B
Low Frequency Signal Generator	Frequency Range: 10 Hz to 10 MHz; Variably attenuated output from 10V p-p @ 50 ohms.	Performance Check; Calibration	Fluke 6011A
High Frequency Signal Generator	Frequency Range: 10 MHz–55 MHz; Variably attenuated output from 1V or 5V rms @ 50 ohms.	Performance Check; Calibration	Wavetek 2001
RF Millivoltmeter	Frequency Range: 10 kHz–1.2 GHz Voltage Range: 500 μV to 3V rms Accuracy: Maximum Error 1% of Reading @ 1.2 GHz + 7% rdg.	Performance Check; Calibration	Boonton 92–B–C–D
Multimeter	Capable of measuring DC voltage: Resistance DC Voltage Range of ±199.9 mV to ±1199V with accuracy better than ±1% of reading Resistance Range of 199.9 ohms to 19.99M ohms with accuracy better than ± .2% of reading.	Troubleshooting	Fluke 8000A Series
Oscilloscope	Dual Trace: 200 MHz Bandwidth	Troubleshooting	Tektronix 475A
Probe	Bandwidth: 220 MHz	Troubleshooting	Tektronix P6202

4-6. Repair Techniques

4-7. INTEGRATED CIRCUIT REPLACEMENT - CMOS AND PMOS TYPES ⓧ

4-8. Table 4-2 lists the MOS types of integrated circuits used in the Model 1920A, for reference during repair. CMOS and PMOS integrated circuits can be destroyed by electrostatic discharge resulting from careless handling. During any repair or replacement procedure involving the handling of these types of integrated circuits, observe the following precautions to prevent damage.

1. CMOS and PMOS integrated circuits are supplied packed in conductive foam. Do not remove the conductive foam from the integrated circuit until ready for installation.

2. Ensure that the repairing personnel and the unit under repair are commonly grounded.

3. Ensure that the soldering iron used is grounded to the common ground.

Table 4-2. MOS–Type Integrated Circuits

Assembly Name	Ref. Des.	Type
Multiplier PCB	U3	CD4046
Main PCB	U1	CD4001
Main PCB	U2	CD4017
Main PCB	U3	CD4049
Main PCB	U4	MK5009
Main PCB	U5, U30	CD4050
Main PCB	U6, U8	CD4013
Main PCB	U7	CD4002
Main PCB	U9	CD4023
Main PCB	U28	1801A
DOU PCB	U1, U7	CD4011
DOU PCB	U2	MC14528
DOU PCB	U3-U6, U8-U13	CD4042
Display PCB	U1	CD4049
Display PCB	U2	CD4001

4-9. GENERAL MAINTENANCE

4-10. Access

4-11. Use the following procedure to gain access to the interior of the Model 1920A.

1. With the power switch OFF, disconnect the line cord.

2. Remove the two Phillips screws at the rear of the instrument case.

3. Remove the instrument from the case.

4-12. Cleaning

4-13. Clean the front panel and case with denatured alcohol or a mild solution of detergent and water. Clean dust from the circuit board with low pressure dry air. Contaminates can be washed from the circuit board with demineralized water and a soft brush (avoid getting excessive amounts of water on the switches).

CAUTION!

Do not use aromatic hydrocarbons or chlorinated solvents for cleaning. These solutions will react with the plastic materials of the instrument.

4-14. Power Fuse Replacement

WARNING!

DISCONNECT THE UNIT FROM LINE POWER BEFORE ATTEMPTING FUSE REPLACEMENT.

1. 100 Vac – 1/4A slo-blo
2. 115 Vac – 1/4A slo-blo
3. 230 Vac – 1/8A slo-blo

4-15. Power supply protection is provided by means of a line fuse having a rating of 0.25 amperes, MDL type, slow-blow. To gain access to the line fuse, loosen the two retaining screws (located on the rear panel) and remove the unit from the case. The line fuse is located in the right rear corner of the main PCB assembly.

4-16. The prescaler input fuse is located on the Prescaler PCB assembly, and is mounted in a socket. To gain access to the fuse, refer to paragraph 4-6. When replacement is required, install Little-Fuse type 273.200, 2/10A, P/N 370577.

4-17. PERFORMANCE CHECKS

4-18. The performance checks provide a means of verifying overall operation of Model 1920A. These procedures are suited for performance evaluation upon receipt of a new instrument, periodic maintenance checks and performance evaluation after repair, and are to be performed between calibration intervals to determine whether or not the instrument is operating within specification. Should the instrument fail to meet any performance requirement, perform the adjustment procedures provided in the Calibration Adjustment procedure. Refer to Table 4-1. (List of Required Test Equipment).

4-19. Functional Check

4-20. To perform a functional check of the Model 1920A, refer to the self-check described in paragraph 2-25.

4-21. Sensitivity Check (Direct Preamplifier)

4-22. Use the following procedures to perform the sensitivity check. (See Figure 4-1 for test set-up configuration.)

1. Connect the generator, set for 10 Hz at 15 mV rms to the counter input.

2. Slowly reduce the input level and confirm that the display goes to zero before readings become unstable or incorrect and that the input is below 15 mV rms.

3. Repeat 2. at 100 Hz, 10 kHz, 1 MHz, 10 MHz, 20 MHz, 40 MHz, 60 MHz, 80 MHz and 100 MHz.

4. Repeat 2. at 125 MHz and confirm that the input level is below 25 mV rms.

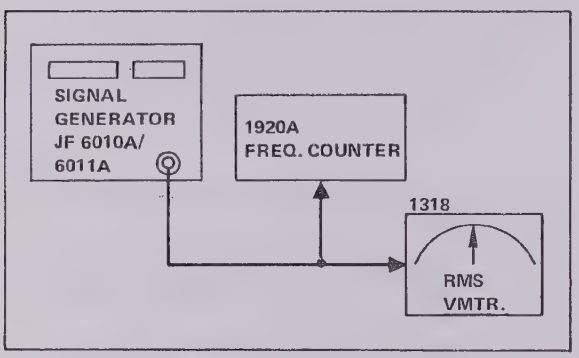


Figure 4-1. Sensitivity Check Test Set-Up

4-23. Sensitivity Check (Prescaler)

4-24. Use the following procedures to perform the prescaler sensitivity check. (See Figure 4-1 for test set-up configuration.)

1. Connect the generator, set for 50 MHz at 15 mV rms to the counter input.

2. Slowly reduce the input level and confirm that the display goes to zero before readings become unstable or incorrect.

3. Repeat step 2. approximately every 100 MHz to the upper limit of the Prescaler.

4. Up to 1000 MHz confirm that the sensitivity is less than 15 mV rms.

4-25. Accuracy Check

4-26. The accuracy of the 1920A is a function of ambient temperature; line voltage and time since last calibration: Dependent on the drift rate characteristics of the internal frequency standard. For example, assume an ambient temperature of 25°C, line voltage ±10% and six months since last calibrated to 10 MHz ± 1 Hz. A 10 MHz frequency standard measured at 1 Hz resolution will read 10000.000 kHz ±28 Hz maximum.

4-27. CALIBRATION ADJUSTMENTS

4-28. Calibration of the 1920A is comprised of various adjustments to individual pcb assemblies. The adjustments should be made after any repairs are completed on individual pcb's or whenever the instrument fails to meet the requirements of the performance check.

4-29. Direct Preamplifier Trigger Level, AGC and Threshold Adjustment

4-30. Adjust the Trigger, (Figure 4-2) AGC and Threshold levels as follows:

1. Set FREQUENCY to 5 Hz - 125 MHz and RESOLUTION to 1 kHz.

2. Connect high frequency signal generator and rms voltmeter terminated by a 50 ohm load to 5 Hz - 125 MHz input.

3. Set AGC trimpot (R10), and THRESHOLD trimpot (R11), to maximum clock-wise position.

4. Set generator to 125 MHz at 25 mV (rms).

5. Adjust TRIGGER (R30) to a mid-point which produces a stable and correct display.

6. Reduce input level until display becomes unstable.

7. Readjust TRIGGER for a stable display.

8. Repeat steps 6 and 7 until no additional increase in sensitivity is possible.

9. Set input frequency to 10 MHz.

10. Reduce input level to the minimum value which still produces a stable and correct reading.

11. Slowly adjust AGC counter-clockwise until reading becomes unstable or incorrect.

12. Slowly adjust AGC (R10) clockwise until reading becomes stable and correct.

13. Repeat steps 11 and 12 for THRESHOLD (R11).

14. Slowly reduce input level ensuring that drop-out is clean.

15. Slowly increase input level until display is stable and correct. Ensure that input level is less than 15 mV (rms). Readjust THRESHOLD (R11) if necessary for clean drop-out.

16. Repeat steps 14 and 15 at 125 MHz, 100 MHz, 50 MHz, 20 MHz and 10 MHz.

17. Connect low frequency generator and repeat steps 14 and 15 at 10 Hz, 100 Hz, 10 kHz, 1 MHz and 5 MHz.

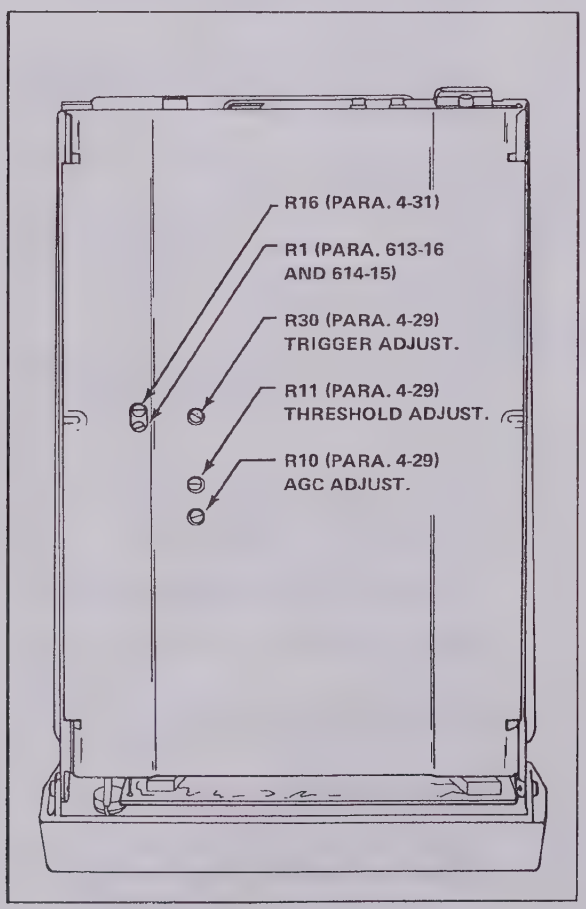


Figure 4-2. Calibration Adjustment Location

4-31. 520 MHz Prescaler AGC Adjsutment (See Figure 4-2 for adjustment locations)

4-32. Adjust the AGC control on the 520 MHz Prescaler PCB assembly as follows:

1. Set FREQUENCY to 50 MHz-520 MHz.

2. Connect high frequency generator and rms voltmeter with high impedance probe to 50 MHz-520 MHz input.

3. Set signal generator to 50 MHz at 15 mV rms.

4. Set AGC (R16) on Prescaler pcb to fully clockwise position. Rotate trimpot slowly counter-clockwise until display is at correct frequency of 50 MHz.

5. Reduce input level until display goes to zero or becomes unstable. If display becomes unstable readjust AGC (R16) until display goes to zero without becoming unstable first.

6. Set signal generator to 85 MHz at 15 mV and repeat 5.

7. Repeat 6 at 100 MHz, 200 MHz, 300 MHz, 400 MHz and 520 MHz.

8. Set signal generator to 50 MHz at 15 mV. Slowly decrease input level until the display goes to zero. Slowly increase input level until display reads 50 MHz. Note input level. Difference should be 1 to 2 mV.

4-33. Time Base Oscillator Adjustment

4-34. Time base oscillator adjustment should be made whenever the oscillator is repaired, or whenever it is determined that accuracy of the counter is not within the accuracy desired. Perform time base oscillator adjustment in an environment having an ambient temperature of +22°C to +25°C (72°F to 77°F).

4-35. The time base oscillator output frequency can be accurately set using either of the two methods given. The first method, using a frequency standard for the reference, should be used whenever a standard is available. The second method uses the WWV broadcast frequency as the calibration standard, and may be used whenever a more suitable frequency standard is not available.

4-36. Time Base Adjustment Using A Frequency Standard

1. Energize the counter and allow it to warm-up for one hour.

2. Remove the counter from the case (paragraph 4-11).

3. Connect the 10 MHz frequency standard to the 5 Hz - 125 MHz input.

4. On the counter, select the 0.1 Hz resoltuion.

5. While observing the display, adjust the TCXO (accessed through the pcb panel, located on the bottom, Not illustrated.) to obtain a reading of 10000.0000 ±10 digits (10000.0000 ±3 digits, option –04.)

4-37. Time Base Adjustment Using WWV

4-38. This procedure requires the counter to be in close proximity to the receiver antenna lead-in cable.

1. Allow unit to warm-up for one hour.

2. Remove the outer cover of the 1920A counter.

3. Tune the SW receiver to the 10 MHz WWV broadcast.

4. Bring the counter near enough to the SW receiver antenna lead so that a zero beat note can be heard on the receiver's speaker. If insufficient radiation is picked up from the counter, turn the time base oscillator towards the antenna and move it in close.

5. Adjust the TCXO (accessed through the pcb panel, located on the bottom.) for a "zero beat" on the receiver.

6. Observe the receiver signal level meter, and adjust the TCXO for null. This should put the timebase oscillator output frequency within 1 Hz of 10 MHz.

4-39. TROUBLESHOOTING

4-40. The following information is designed to aid in troubleshooting the Model 1920A. Fault isolation is achieved by executing the self-check described in Section 2 and noting the symptoms described in Table 4-3 Display Troubleshooting Fault Isolation.

4-41. A provision has been made to check all segments of all LED's for the purpose of determining whether or not a dark segment (s) is due to a faulty LED or other circuitry. To light all segments of all LED's press the FREQUENCY CHECK and RESET switches.

Table 4-3. Display Troubleshooting, Fault Isolation

Description/Symptom		Yes	No	Go To
1.	Perform self check using 1 Hz resolution.			2
2.	Is Gate Lamp flashing at approx. (1 Hz)?	3	10	
3.	Depress reset switch.			4
4.	Are all digits dark?	5	11	
5.	Is 100 kHz present on pin 1 of U28?	7	6	
6.	Check U28.			5
7.	Is pin 15 of U28 pulsing between 0V and 5V?	9	8	
8.	Check U28 and U30.			7
9.	Check U29.			7
10.	Check power supplies, batteries, ac connector, fuse, etc.			2
11.	Is one or more digits dark?	12	15	
12.	Is 90 μsec pulse on corresponding strobe output of U28?	14	13	
13.	Replace U28.			11
14.	Check drivers, transistors Q9 to Q26.			12
15.	Is dark segment common to all digits?	16	17	
16.	Check U28, U29, U30,			15
17.	Replace faulty LED.			11
18.	No decimal?			19
19.	Perform display check through all resolution ranges.			20
20.	Is decimal missing from any LED's?	21	24	
21.	Is decimal missing from all LED's?	22	24	
22.	Check Q1 on display pcb.			21
23.	Replace faulty LED			20
24.	Test completed.			

Section 5
List of Replaceable Parts

TABLE OF CONTENTS

REFERENCE DESIGNATOR	ASSEMBLY NAME	PAGE
	1920A Final Assembly	5-3
	Front Panel Assembly	5-7
A1	Display PCB Assembly	5-9
A2	Main PCB Assembly	5-11
A3	Direct Preamplifier PCB Assembly	5-18
A4	520 MHz Prescaler PCB Assembly	5-22

5-1. INTRODUCTION

5-2. This section contains an illustrated parts breakdown of the instrument. Components are listed alphanumerically by assembly. Electrical components are listed by reference designation and mechanical components are listed by item number. Each listed part is shown in an accompanying illustration.

5-3. Parts list include the following information:

1. Reference Designation or Item Number.

2. Description of each part.

3. Fluke Stock Number.

4. Federal Supply Code for Manufacturers. (see Appendix A for Code-to-Name list.)

5. Manufacturer's Part Number of Type.

6. Total Quantity per assembly or component.

7. Recommended Quantity: This entry indicates the recommended number of spare parts necessary to support one to five instruments for a period of two years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for one year or more at an isolated site, it is recommended that at least one in each assembly in the instrument be stocked. In the case of optional subassemblies, plug-ins, etc. that are not always part of the instrument, or are deviations from the basic instrument mode, the REC QTY column lists the recommended quantity of the item in that particular assembly.

NOTE

The revision letter is stamped or written on the component side of each pcb.

5-4. HOW TO OBTAIN PARTS

5-5. Components may be ordered directly from the manufacturer by using the manufacturer's part number, or from the John Fluke Mfg. Co., Inc. factory or authorized representative by using the FLUKE STOCK NUMBER. In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

5-6. To ensure prompt and efficient handling of your order, include the following information.

1. Quantity.

2. FLUKE Stock Number.

3. Description.

4. Reference Designation or Item Number.

5. Printed Circuit Board Part Number.

6. Instrument Model and Revision Letter.

⊗ CAUTION

Indicated devices are subject to damage by static discharge.

Table 5-1. Final Assembly

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	FINAL ASSEMBLY Figure 5-1						
	Front Panel Assembly (1920A-4003T) Figure 5-2						
A1	**Display PCB Assembly (1920A-4004T) Figure 5-3**	398321	89536	398321	1		
A2	**Main PCB Assembly** **115/230V (1920A-4001T)** **100V (1920A-4011T)** **Figure 5-4**	398305 411769	89536 89536	398305 411769	1 1		
A3	**Direct PreAmp PCB Assembly (1920A-4004T) Figure 5-5**	398347	89536	398347	1		
A4	**520 MHz Prescaler PCB Assembly (1953A-4026T) Figure 5-6**	396291	89536	396291	1		
1	Bearing	376996	89536	376996	1		
2	Clamp, cable	172080	06383	SST-1M	2		
3	Connector, BNC coax	152033	95712	30355-1	1		
4	Decal, external clock	444612	89536	444612	1		
5	Filter, line	321273	05245	3EF2	1		
	Hardware						
6	Lug, ground	441972	73734	118100	1		
7	Lug, solder	102558	79963	124	1		
(8)	Nut, replacement, plastic	364737	89536	110635	2		
9	Nut, 4-40	110635	89536	110635	1		
10	Screw, FHP, 4-40 x 1/4	114884	89536	114884	3		
11	Screw, PHP, 4-40 x 1/4	129890	73734	14022	1		
13	Screw, PHP, 4-40 x 3/8	152124	73734	19024	1		
14	Screw, PHP, 4-40 x 3/8	281196	89536	281196	1		
15	Screw, PHP, 6-32 x 3/16	381087	73734	19041	4		

Table 5-1. Final Assembly (cont)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
16	Screw, PHP, 6-32 x 1/4	385799	89536	385799	4		
17	Washer, internal tooth, 4-40	110338	89536	110338	1		
18	Panel, rear	398214	89536	398214	1		
19	Panel, side	388264	89536	388264	2		
20	Pushrod Assembly	398453	89536	398453	1		
21	Ring, retainer	355586	79136	5133-12-HR	1		
22	Spacer, teflon	446856	89536	446856	1		
23	Adapter (used on 100V only), not illustrated	100222	89536	100222	1		
25	Decal, handle	347401	89536	347401	2		
26	Foot, pad	338632	89536	338632	2		
27	Handle, case	414581	89536	414581	1		
	Hardware:						
28	Screw, 6 - 20 x 5/8	156489	89536	156489	2		
29	Screw, 6 - 20 x	288266	89536	288266	2		
30	Washer, flat no.	340505	73734	1404	2		
	Instruction Manual not illustrated	400101	89536	400101	1		
	Line cord (not illustrated)	343723	89536	343723	1		
31	Shield, bottom	439943	89536	439943	1		
32	Shield, top	439935	89536	439935	1		

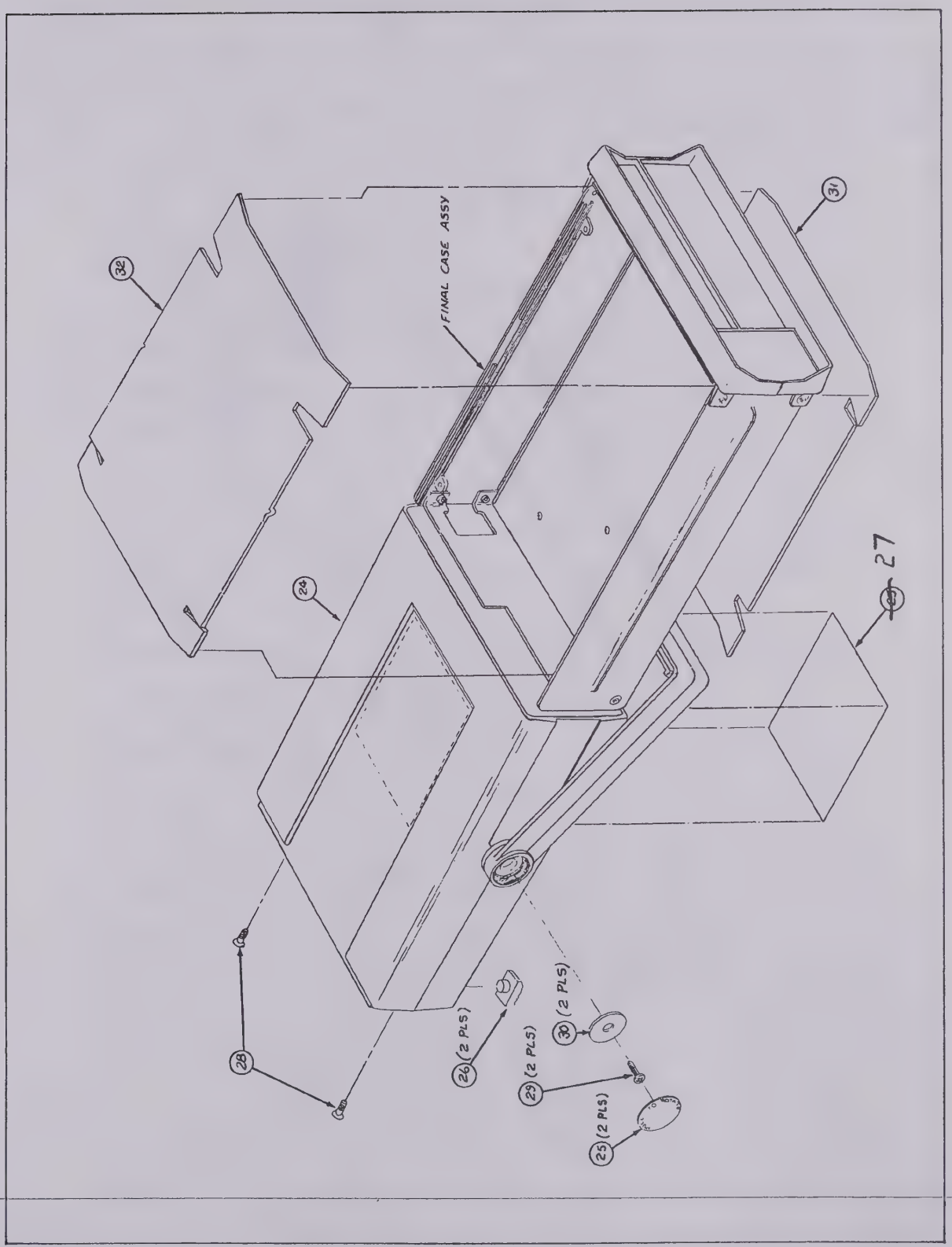


Figure 5-1. Final Assembly (Sheet 1 of 2)

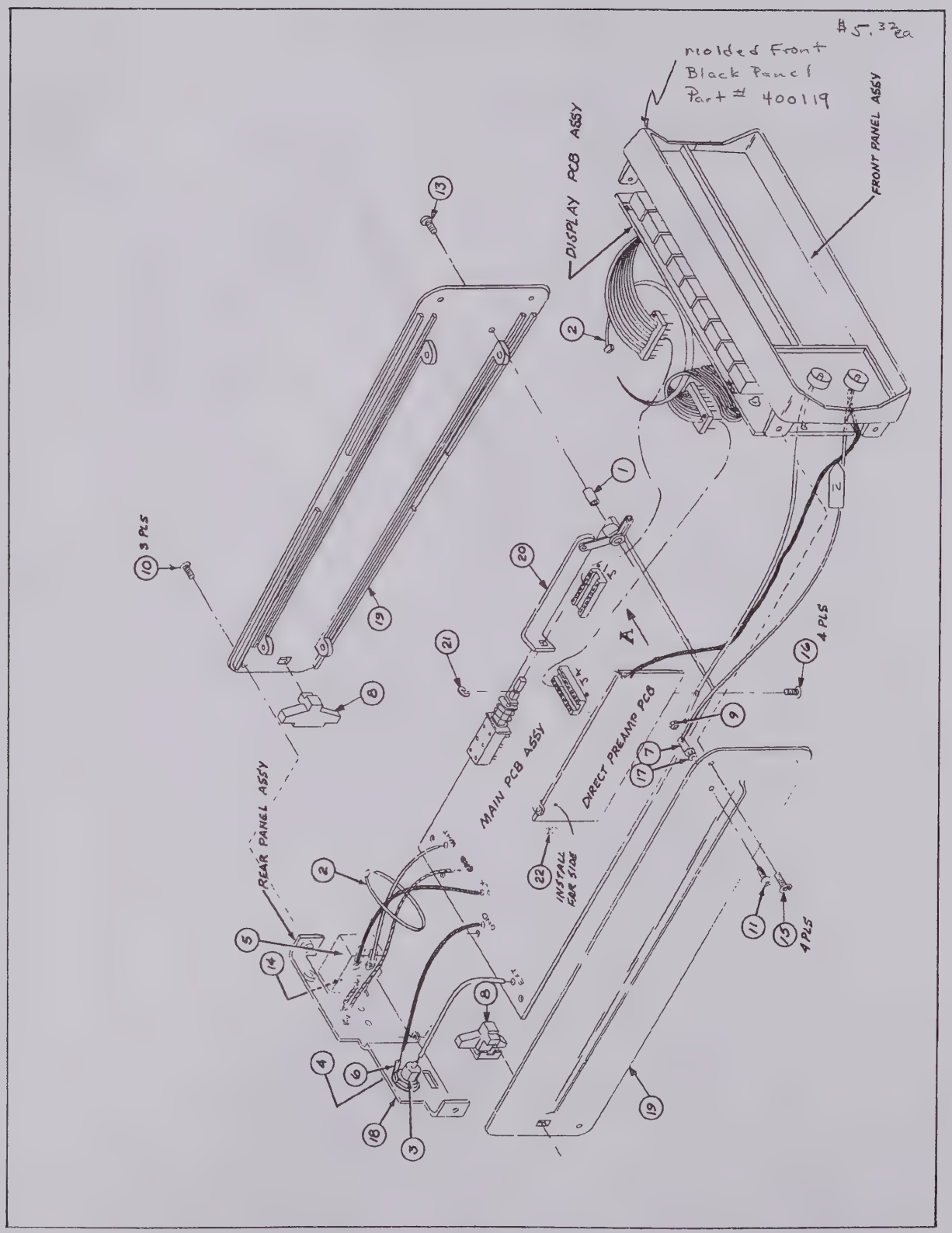


Figure 5-1. Final Assembly (Sheet 2 of 2)

Tel 303-750-1228

Table 5-2. Front Panel Assembly

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	FRONT PANEL ASSEMBLY (1920A-4451) Figure 5-2						
A1	**Display PCB Assembly (1920A-4003) Figure 5-3**	398321	89536	398321	REF		
1	Actuator, piano-key (green)	420604	89536	420604	1		
2	Actuator, piano-key (grey	420596	89536	420596	10		
3	Cable Assembly	398461	89536	398461	1		
4	Cable Assembly, coax	433326	89536	433326	1		
5	Connector, BNC	152033		30355-1	1		
6	Decal, front	398248	89536	398248	1		
7	Decal, input	398230	89536	398230	1		
	Hardware:						
8	Screw, PHP, 4-40 x 1/4	178590	89536	178590	2		
9	Lens	398263	89536	398263	1		
10	Lug, ground	167015	73734	118100	2		
11	Ring, retaining	355586	79136	5133-12-HR	11		
12	Slug	364745	89536	364745	11		

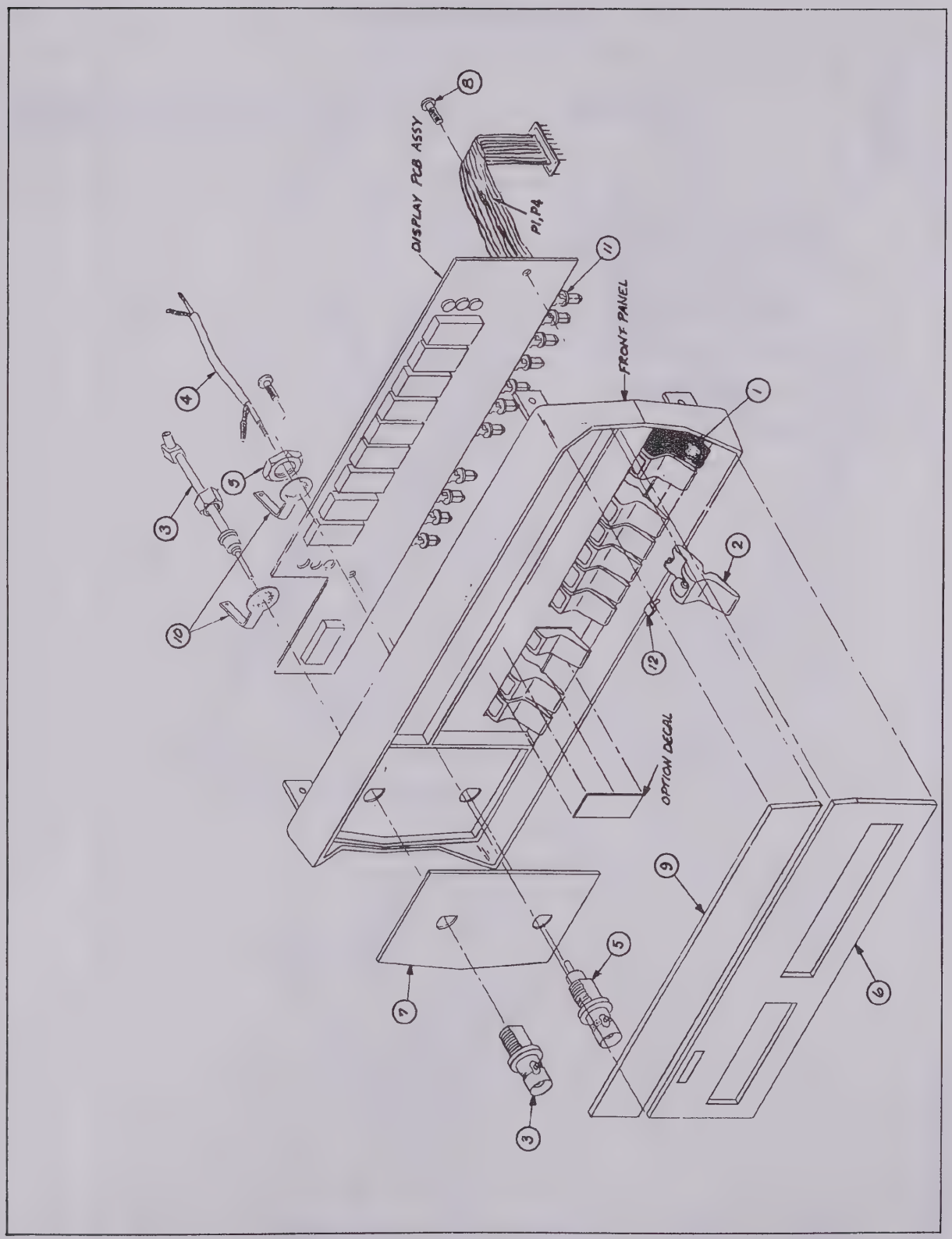


Figure 5-2. Front Panel Assembly

Table 5-3. A1 Display PCB Assembly

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A1	**DISPLAY PCB ASSEMBLY (1920A-4003) Figure 5-3**	398321	89536	398321	REF		
DS1 thru DS6	Diode, LED, clear	385898	28480	5082-4487	6	6	
P1, P4	Cable Assembly	393520	89536	393520	2		
P10	Conn, post	379438	00779	87022-1	3		
Q1	Xstr, Si, NPN	218396	04713	2N3904	1	1	
R1, R3	Res, comp, 330 ±5%, 1/4W	147967	01121	CB3315	3		
R2	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	1		
R4	Res, comp, 39k ±5%, 1/4W	193391	01121	CB3935	1		
R5	Res, comp, 330 ±5%, 1/4W	147967	01121	CB3315	REF		
S1 thru S11	Switch Assembly	402164	89536	402164	1		
U1	IC, Dgtl, C-MOS, hex buffer/inverters	381848	02735	CD4049AE	1	1	
U2	IC, Dgtl, COS/MOS, quad 2-input, NOR gates	355172	02735	CD4001AE	1	1	
U3 thru U11	Dio, light emitting (LED) display [1]	429985	28480	5082-7728	9	9	

[1] Specify brightness code (C, D or E) located on the side of the LED when ordering.

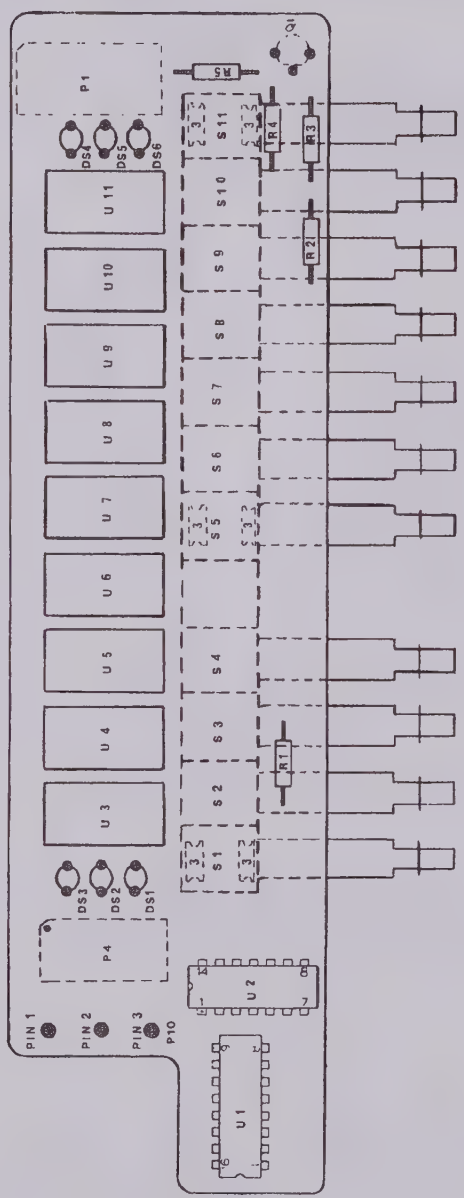


Figure 5-3. A1 Display PCB Assembly

Table 5-4. A2 Main PCB Assembly

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A2	MAIN PCB ASSEMBLY (1920-4001T) 115/230V	398305	89536	398305			
	(1920A-4011T) 100V	411769	89536	411769			
	Figure 5-4						
C1	Cap, elect, 470 µF -10/+100%, 15V	379370	25088	B41010-4700 /16	1	1	
C2	Cap, elect, 470 µF -10/+50%, 40V	185868	73445	ET471X0400 A02	1	1	
C3	Cap, elect, 100 µF -10/+50%, 40V	236919	73445	ET101X040-A6	1	1	
C4	Cap, Ta, 10 µF ±20%, 15V	193623	56289	196D106X-0015KA1	2		
C5	Cap, cer, 0.01 µF ±20%, 100V	407361	72982	8121-A100-W5R-103M	2		
C6 thru C10	Cap, cer, 0.01 µF -20/+80%, 25V	335786	72982	5835-000-Y5U-103Z	11		
C11	Cap, Ta, 10 µF ±20%, 15V	193623	56289	196D106X-0015KA1	REF		
C12	Cap, elect, 1500 µF -10/+50%, 6.3V	166330	73445	ET152X6P 3A01	1	1	
C13	Cap, cer, 0.01 µF -20/+80%, 25V	335786	72982	5835-000-Y5U-103Z	REF		
C14	Cap, cer, 1000 pF ±10%, 500V	357806	56289	C106B102 G102K	5		
C16, C17	Cap, cer, 0.01 µF -20/+80%, 25V	335786	72982	5835-000-Y5U-103Z	REF		
C18	Cap, cer, 1000 pF ±10%, 500V	357806	56289	C106B102 G102K	REF		
C19	Cap, cer, 0.01 µF ±20%, 100V	407361	72982	8121-A100-W5R-103M	REF		
C21	Cap, Ta, 10 µF ±20%, 35V	417683	56289	196D106X 0035PE4	1		
C22	Cap, cer, 0.01 µF -20/+80%, 25V	335786	72982	5835-000-Y5U-103Z	REF		
C23	Cap, cer, 10 pF ±10%, 3 kV	105536	56289	40C362A1	1		

Table 5-4. A2 Main PCB Assembly (cont)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
C24, C25	Cap, cer, 0.01 μF -20/+80%, 25V	335786	72982	5835-000-Y5U-103Z	REF		
C26, C27	Cap, cer, 1000 pF ±10%, 500V	357806	56289	C106B102 G102K	REF		
C28	Cap, pollycarb, 0.0047 μF ± 10%, 100V	288902	84411	X463UW 47291W	1		
C29	Cap, cer, 1000 pF ±10%, 500V	357806	56289	C106B102 G102K	REF		
CR1, CR2	Diode, rectifier, bridge	296509	09423	FB200	2	1	
CR3 thru CR7	Diode, Si, Hi-speed switching	203323	07910	1N4448	5	1	
CR8	Diode, zener, 6.2V	325811	07910	1N753A	1	1	
F1	Fuse, slo-blo, 1/4 amp	166306	71400	MDL1-4	1	5	
J1, J4, J6	Socket, 16 pin, IC	387324	71785	133-59-02-062	3		
J8	Socket, 16 pin, IC	276535	91506	316-AG39D	1		
P6	Res, shorting plug	413039	89536	413039	1		
Q1	Xstr, Si, PNP	369629	07263	2N5771	4	1	
Q2	Xstr, Si, PNP	269076	04713	2N4890	1	1	
Q3, Q4, Q5	Xstr, Si, PNP	369629	07263	2N5771	REF		
Q6	Xstr, Si, PNP	369652	01295	A5T4061/SX 4061/T1P5T 4061	2	1	
Q7	Xstr, Si, PNP	352369	07263	2N4403	10	2	
Q8 thru Q12	Xstr, Si, NPN	218396	04713	2N3904	11	3	
Q13 thru Q16	Xstr, Si, PNP	352369	07263	2N4403	REF		
Q17 thru Q21	Xstr, Si, NPN	218396	04713	2N3904	REF		

Table 5-4. A2 Main PCB Assembly (cont)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
Q22 thru Q26	Xstr, Si, PNP	352369	07263	2N4403	REF		
Q27	Xstr, Si, NPN	218396	04713	2N3904	REF		
Q28	Xstr, Si, PNP	369652	01295	A5T4061/SX 4061/T1P 5T4061	REF		
R1	Res, comp, 150 ±5%, 1W	178566	01121	GB1515	1		
R2, R3, R4	Res, comp, 22k ±5%, 1/4W	148130	01121	CG2235	3		
R5	Res, comp, 10k ±5%, 1/4W	148106	01121	CG1035	3		
R6	Res, comp, 4.7k ±5%, 1/4W	148072	01121	CG4725	2		
R7	Res, comp, 220 ±5%, 1/4W	147959	01121	CG2215	3		
R8	Res, comp, 1k ±5%, 1/4W	148023	01121	CG1025	12		
R9	Res, comp, 220 ±5%, 1/$W	147959	01121	CG2215	REF		
R11	Res, comp, 10k ±5%, 1/4W	148106	01121	CB1035	REF		
R12, R13	Res, comp, 1M ±5%, 1/4W	182204	01121	CB1055	2		
R14	Res, comp, 100k ±5%, 1/4W	148189	01121	CB1045	4		
R15	Res, comp, 2.7k ±5%, 1/4W	170720	01121	CB2725	2		
R16	Res, comp, 1k ± 5%, 1/4W	148023	01121	CG1025	REF		
R17	Res, comp, 3.3k ±5%, 1/4W	148056	01121	CB3325	2		
R18, R19	Res, comp, 100k ±5%, 1/4W	148189	01121	CB1045	REF		
R20	Res, comp, 1k ± 5%, 1/4W	148023	01121	CG1025	REF		
R21	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	REF		
R22	Res, comp, 1.2k ±5%, 1/4W	190371	01121	CB1225	1		
R23	Res, comp, 150k ±5%, 1/4W	182212	01121	CB1545	1		
R24, R25 R26	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	REF		
R27	Res, comp, 4.7k ±5%, 1/4W	148072	01121	CB4725	REF		

Table 5-4. A2 Main PCB Assembly (cont)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R28	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	REF		
R29	Res, comp, 10k ±5%, 1/4W	148106	01121	CB1035	REF		
R30	Res, comp, 270 ±5%, 1/4W	160804	01121	CB2715	2		
R31	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	REF		
R32	Res, comp, 220 ±5%, 1/4W	147959	01121	CB2215	REF		
R33	Res, comp, 2.7k ±5%, 1/4W	170720	01121	CB2725	REF		
R34	Res, comp, 2.2k ±5%, 1/4W	148049	01121	CB2225	1		
R35, R36	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	REF		
R37	Res, comp, 180 ±5%, 1/4W	147942	01121	CB1815	1		
R38	Res, comp, 3.3k ±5%, 1/4W	148056	01121	CB3325	REF		
R39	Res, comp, 180 ±5%, 1/4W	147942	01121	CB1815	REF		
R40	Res, comp, 33 ±5%, 1/4W	175034	01121	CB3305	1		
R41	Res, comp, 270 ±5%, 1/4W	160804	01121	CB2715	REF		
R42	Res, comp, 180 ±5%, 1/4W	147942	01121	CB1815	REF		
R43	Res, comp, 100k ±5%, 1/4W	148189	01121	CB1045	REF		
R44	Res, comp, 100 ±5%, 1/4W	147926	01121	CB1015	1		
R50	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	REF		
S1	Switch, power	403618	89536	403618	1		
S2	Switch, 115/230	376798	89536	376798	1		
S3	Switch, slide, dpdt	404814	79727	G1-152-PC			
T1	Xfmr, power (115/230V, 1920A-4001)	402206	89536	402206	1		
T1	Xfmr, power (100V, 1920A-4011)	407379	89536	407379	1		
U1	⊗ IC, Dgtl, COS/MOS, NOR gates	355172	02735	CD4001AE	1	1	
U2	⊗ IC, Dgtl, C-MOS, decade, counter/divider	403568	02735	CD4017AE	1	1	
U3	⊗ IC, Dgtl, C-MOS, hex buffer/inverter	381848	02735	CD4049AE	1	1	

Table 5-4. A2 Main PCB Assembly (cont)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
U4	⊗IC, MOS, counter time base circuit	381822	50088	MK5009P	1	1	
U5	⊗IC, Dgtl, C-MOS, hex buffer/inverter	381830	02735	CD4050AE	2	1	
U6	⊗IC, C-MOS, dual type "D" flip-flops	340117	02735	CD4013AE	2	1	
U&	⊗IC, Dgtl, COS/MOS, NOR gates	363820	02735	CD4002AE	1	1	
U8	⊗IC, C-MOS, dual type "D" flip-flop	340117	02735	CD4013AE	REF		
U9	⊗IC, Dgtl, C-MOS, triple 3-input NAND gates	375147	02735	CD4023AE	1	1	
U10	IC, Dgtl, Quad, 2-input POS NOR gates	288845	01295	SN7402N	1	1	
U11	IC, Lin, vol regulator 7815	402768	07263	F7818UC	1	1	
U12	IC, Lin, vol regulator 7805	355107	07263	F7805UC	1	1	
U13	IC, Lin, pos voltage regulator	408138	07263	78L12AWC	2	1	
U14	IC, Lin, fifferential voltage comparator	429050	12040	LM710CN	1	1	
U15	IC, Dgtl, TTL, MSI, decade counter	402545	01295	SN74LS90	2	1	
U16	IC, Dgtl, TTL, MSI, quad, data selector/ multiplexer	407833	01295	SN74LS157N	1	1	
U17	IC, TTL, 4-bit binary counter	320739	01295	SN7493AN	1	1	
U18	IC, Lin, Op amp	402750	12040	LM741CN	1	1	
U19	IC, Lin, timer	402610	12040	LM555CN	1	1	
U20	IC, Dgtl, ECL, triple 4-3-3 input NOR gate	402735	07263	F95106DC	1	1	
U21	IC, Dgtl, ECL, edge-triggered J-K flip-flops	402743	07263	F95029DC	1	1	
U22	IC, Lin, pos voltage regulator	408138	07263	78L12AWC	REF		
U23	IC, Dgtl, TTL, Quad 2-input pos NAND gates	393033	01295	SN74LS00	1	1	
U24	IC, Dgtl, TTL, MSI, decade counter	402545	01295	SN74LS90	REF		
U25	IC, Dgtl, TTL, Quad, 2-input pos NOR gates	403626	01295	SN74S02N	1	1	
U26, U27	IC, TTL, dual J-K edge triggered flip-flop	363440	01295	SN74S112	2	1	
U28	⊗IC, Dgtl, MOS, 7 digit, 2.5 MHz decimal counter	380238	55261	1801A	1	1	
U29	IC, TTL, BCD-to-seven seg decoder/driver	340109	01295	SN7447AN	1	1	
U30	⊗IC, Dgtl, C-MOS, hex buffer/inverters	381830	02735	CD4050AE	REF		

Table 5-4. A2 Main PCB Assembly (cont)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
U31	Res, network, dual-in-line, one value	412866	89536	412866	1	1	
XF1	Clip, fuse	284984	84613	3621-2	1		
XU4, XU20, XU21, XU26, XU27	Socket, IC, 16 pin	370312	91506	316-AG39D	5		
XU25	Socket, IC, 14 pin	291452	00779	583527-1	1		
XU28	Socket, IC, 40 pin	376244	91506	340-AG39D	1		
1	Decal, warning	386250	89536	386250	1		
2	Conn, post	376574	00779	3-87022-1	19		
3	Conn, post	379438	00779	1-87022-0	8		

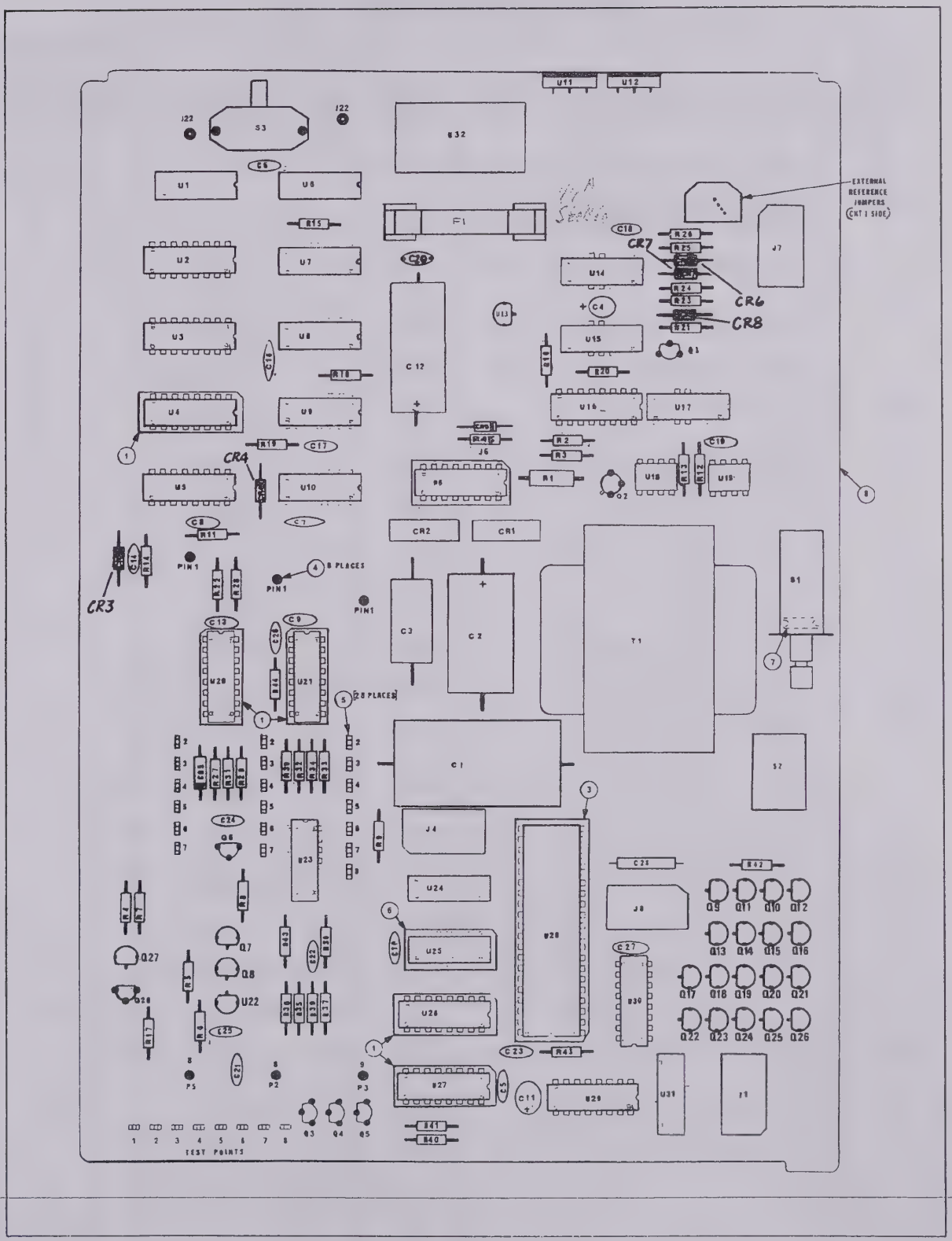


Figure 5-4. A2 Main PCB Assembly

Table 5-5. A3 Direct Preamplifier PCB Assembly

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A3	DIRECT PREAMPLIFIER PCB ASSEMBLY (1920A-4004T) Figure 5-5	398347	89536	398347	REF		
C1	Cap, polystm film, 0.10 μF ±20%, 250V	441345	73445	C281AE/ A100K	1		
C2	Cap, cer, 47 pF ±20%, 1000V	369132	56289	C030B102H 470J	1		
C3	Cap, cer, 22 pF ±20%, 500V	369157	72982	10TCC-Q22	2		
C4	Cap, Ta, 22 μF ±20%, 15V	423012	56289	196D226X 015KA1	3		
C5	Cap, cer, 22 pF ± 20%, 500V	369157	72982	10TCC-Q22	REF		
C6	Cap, Ta, 10 μF ±20%, 16V	193623	56289	196D106X 0015JA1	6		
C7	Cap, cer, 0.01 μF ± GMV, 16V	368639	71590	UK-16-103	3		
C8	Cap, Ta, 22 μF ±20%, 15V	423012	56289	196D226X 0015KA1	REF		
C9	Cap, cer, 0.01 μF ± GMV, 16V	368639	71590	UK-16-103	REF		
C10	Cap, cer, 0.001 μF ±10%, 500V	357806	71590	CF102	3		
C11	Cap, Ta, 10 μF ±20%, 16V	193623	56289	196D106X 0015JA1	REF		
C12	Cap, Ta, 22 μF ±20%, 15V	423012	56289	196D226X 0015KA1	REF		
C13	Cap, cer, 0.001 μF ±10%, 500V	357806	71590	CF102	REF		
C14, C15	Cap, Ta, 10 μF ±20%, 16V	193623	56289	196D106X 0015JA1	REF		
C16	Cap, cer, 0.001 μF ±10%, 500V	357806	71590	CF102	REF		
C17, C18	Cap, cer, mini, 100 pF ±2%, 100V	369173	72982	8141-A100-COG-101G	2		
C19	Cap, cer, 0.01 μF ± GMV, 16V	368639	71590	UK-16-103	REF		
C20	Cap, Ta, 10 μF ±20%, 16V	193623	56289	196D106X 0015JA1	REF		
C21	Cap, cer, 470 ±10%, 1000V	368613	71590	DD-471	1		
C22	Cap, Ta, 10 μF ±20%, 16V	193623	56289 0015JA1	196D106X	REF		

Table 5-5. A3 Direct Preamplifier PCB Assembly (cont)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
CR1, CR2	Diode, fast act, low cap, Si	381806	07263	1N3062	4	1	
CR3, CR4	Diode, sm sig	402776	28480	MP3379	3	1	
CR5, CR6	Diode, Hi-speed switch	203323	07910	1N4448	2	1	
CR7, CR8, CR9	Diode, hot-carrier	369595	07263	FH1100	3	1	
CR10	Diode, fast, low cap, Si	381806	07263	1N3062	REF		
CR11	Diode, sm sig	402776	28480	MP3379	REF		
CR12	Diode, fast, low-cap, Si	381806	07263	1N3062	REF		
CR13	Diode, Zener, 3.3V	309799	07263	1N7464	1	1	
Q1	Xstr, FET, N-channel	403634	89536	403634	1	1	
Q2, Q4	Xstr, Si, NPN	419275	01295	BF357K	2	1	
Q3	Xstr, Si, PNP	369629	07263	2N5771	1	1	
Q5, Q6	Xstr, FET, N-channel	272120	89536	272120	2	1	
R1	Res, comp, 120k ±5%, 1/4W	193458	01121	CB1245	1		
R2	Res, comp, 100k ±10%, 1/8W	261826	01121	BB1011	3		
R3	Res, comp, 1M ±5%, 1/4W	182204	01121	CB1055	4		
R4, R5	Res, comp, 10k ±5%, 1/4W	148106	01121	CB1035	9		
R6	Res, comp, 220 ±10%, 1/8W	153197	01121	BB2211	1		
R7	Res, comp, 2.2k ±10%, 1/8W	153965	01121	BB2221	1		
R8, R9	Res, comp, 10k ±5%, 1/4W	148106	01121	CB1035	REF		
R10, R11	Res, var, car, 10k ±20%, 0.20W	385393	56489	PT10H(2.5) 10K	3	1	
R12, R13	Res, comp, 10k ±5%, 1/4W	148106	01121	CB1035	REF		
R14, R15	Res, comp, 4.7k ±5%, 1/4W	148072	01121	CB4725	2		
R16	Res, comp, 1M ±5%, 1/4W	182204	01121	CB1055	REF		
R17	Res, comp, 68k ±10%, 1/8W	423111	01121	BB6831	1		

Table 5-5. A3 Direct Preamplifier PCB Assembly (cont)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R18	Res, comp, 560 ±10%, 1/8W	115303	01121	BB5611	1		
R19	Res, comp, 10k ±10%, 1/8W	246975	01121	BB1031	1		
R20	Res, comp, 100k ±10%, 1/8W	261826	01121	BB1011	REF		
R21	Res, comp, 1.2k ±10%, 1/8W	115329	01121	BB2221	1		
R22, R23	Res, comp, 10 ±5%, 1/4W	147868	01121	CB1005	2		
R24	Res, comp, 1M ±5%, 1/4W	182204	01121	CB1055	REF		
R25	Res, comp, 1k ±10%, 1/8W	153916	01121	BB1011	1		
R26	Res, comp, 1M ±5%, 1/4W	182204	01121	CB1055	REF		
R27	Res, comp, 180k ±5%, 1/4W	193441	01121	CB1845	1		
R28	Res, comp, 220k ±5%, 1/4W	160937	01121	CB2245	1		
R29	Res, comp, 10k ±5%, 1/4W	148106	01121	CB1035	REF		
R30	Res, var, car, 10k ±20%, 0.20W	385393	56489	PT-10H(2.5) 10K	REF		
R31	Res, comp, 56k ±5%, 1/4W	170738	01121	CB5635	1		
R32, R33, R34	Res, comp, 2.2k ±5%, 1/4W	148049	01121	CB2225	4		
R35, R36	Res, comp, 560 ±5%, 1/4W	147991	01121	CB5615	6		
R37	Res, comp, 2.2k ±5%, 1/4W	148049	01121	CB2225	REF		
R38, R39	Res, comp, 270 ±5%, 1/4W	160804	01121	CB2715	2		
R40	Res, comp, 100 ±5%, 1/8W	261826	01121	BB1011	REF		
R41, R42	Res, comp, 470 ±5%, 1/4W	147983	01121	CB4715	2		
R43 thru R46	Res, comp, 560 ±5%, 1/4W	147991	01121	CB5615	REF		
R47, R49	Res, comp, 10k ±5%, 1/4W	148106	01121	CB1035	REF		
R48	Res, comp, 47 ±5%, 1/4W	147892	01121	CB4705	1		
U1	IC, Lin, Op Amp	402669	12040	LM324	1	1	

Table 5-5. A3 Direct Preamplifier PCB Assembly (cont)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
U2	IC, triple-line receiver	402727	07263	F95116	1	1	
XN2	Socket, IC, 16 pin	370312	01295	C931602	1		
2	Conn, test jack	149112	74970	105-0753	2		
3	Receptacle, amp	375329	00779	85863-3	6		

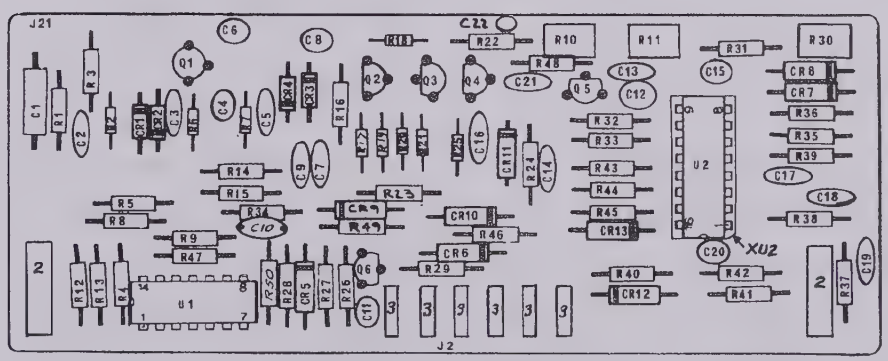


Figure 5-5. A3 Direct Preamplifier PCB Assembly

Table 5-6. A4 520 MHz Prescaler PCB Assembly

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A4	520 MHz PRESCALER PCB ASSEMBLY (1953A-4026T) Figure 5-6	396291	89536	396291	REF		
C1, C2	Cap, cer, .001 μF ± 20%, 100V	402966	72982	8121-A100-W5R-102M	6		
C3	Cap, cer, 100 pF ± 10%, 500V	357806	71590	CF102	3		
C4	Cap, cer, .001 μF ± 20%, 100V	402966	72982	8121-A100-W5R-102M	REF		
C5	Cap, cer, 0.01 μF ± 20%, 100V	407361	72982	W5R-103M	2		
C6, C7	Cap, Cer, .001 μF ± 20%, 100V	402966	72982	8121-A100-W5R-102M	REF		
C8	Cap, cer, 22 pF ± 20%, 500V	369157	72982	831-000-C060-220	1		
C9	Cap, cer, .001 μF ± 20%, 100V	402966	72982	8121-A100-W5R-102M	REF		
C10	Cap, cer, 0.01 μF ± 20%, 100V	407361	72981	W5R-103M	REF		
C11, C12	Cap, cer, 1000 pF ± 10%, 500V	357806	71590	CF102	REF		
C13, C14	Cap, cer, 0.01 μF ± 20%, 100V	149153	28480	C023B101F	2		
C15	Cap, cer 2700 pF ± 20%, 100V	362889	72982	8121-A100-W5R-272M	1		
C16	Cap, cer, 10 μF ± 20%, 15V	193623	56289	196D106X0015-KA1	1		
CR8	Diode, Si Hi-speed switch	203323	07919	1N4448	1	1	
CR3, CR4	Diode, sm signal uhf/vhf	402776	28480	HP5082-3379	3	1	
CR6, CR7	Diode, hot carrier	369595	07263	CH1100	2	1	
CR9	Diode, Zener	159798	07263	1N751A	1	1	
F1, F2	Fuse, 2/10 amp, 2.6 ohm	370557	75915	273200	2	10	
J5	Connector, test jack	149112	74970	105-0753	2		
J20	Connector, coaxial, con-hex	353243	98291	51-053-000	1		
Q1	Xstr, Si, NPN	177105	07263	2N3565	2		
Q2	Xstr, PNP, Si, to-92	352369	07263	2N4403	1	1	
Q3	Xstr, NPN, Si	177105	07263	2N3565	REF		
Q4	Xstr, Si, NPN	369645	07263	2N4274	1		
R1	Res, comp, 82 ± 5%, 1/4W	149484	01121	CB8205	2		

Table 5-6. A4 520 MHz Prescaler PCB Assembly (cont)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R2	Res, comp, 22 ±5%, 1/4W	147884	01121	CB2205	1		
R3	Res, comp, 470 ±5%, 1/4W	147983	01121	CB4715	3		
R4	Res, comp, 680 ±5%, 1/4W	148007	01121	CB6815	1		
R5	Res, comp, 470 ±5%, 1/4W	147983	01121	CB4715	REF		
R6	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	3		
R7	Res, comp, 2.7k ±5%, 1/4W	170720	01121	CB2725	4		
R8	Res, comp, 68 ±5%, 1/4W	147918	01121	CB6805	1		
R9	Res, comp 10k ±5%, 1/4W	148106	01121	CB1035	3		
R10	Res, comp, 2.7k ±5%, 1/4W	170720	01121	CB2725	REF		
R11	Res, comp, 470 ±5%, 1/4W	147983	01121	CB4715	REF		
R12, R13	Res, comp, 2.7k ±5%, 1/4W	170720	01121	CB2725	REF		
R14	Res, comp, 82 ±5%, 1/4W	149484	01121	CB8205	REF		
R15	Res, comp, 10k ±5%, 1/4W	148106	01121	CB1025	REF		
R16	Res, var, comp, 10k ±20%, 20V	385393	54869	PT10(25)10K	1	1	
R17	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	REF		
R18	Res, comp, 2.2M ±5%, 1/4W	198390	01121	CB2255	1		
R19	Res, comp, 330k ±5%, 1/4W	192948	01121	CB3345	1		
R20	Res, comp, 10k ±5%, 1/4W	148106	01121	CB1035	REF		
R21	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	REF		
R22	Res, comp, 1M ± 5%, 1/4W	18220A	01121	CB1055	1		
U1	IC, Lin VHF/UHF, wide band amp	392977	25403	ATF417	1	1	
U2	IC, Lin, hybrid, amp 5-400 MHz	402594	24539	GPD402	1	1	
U3	IC, Dgtl, ECL, divide-by-four counter	402719	07263	11C05PC	1	1	
U4	IC, op amp	402750	07263	741TC	1	1	
XF1, XF2	Fuse socket, spring type	403642	00779	50863-8	4		
XJ5	Receptacle, amp	375329					
XU3	Socket, IC 14 pin	291542	00779	583527	1		

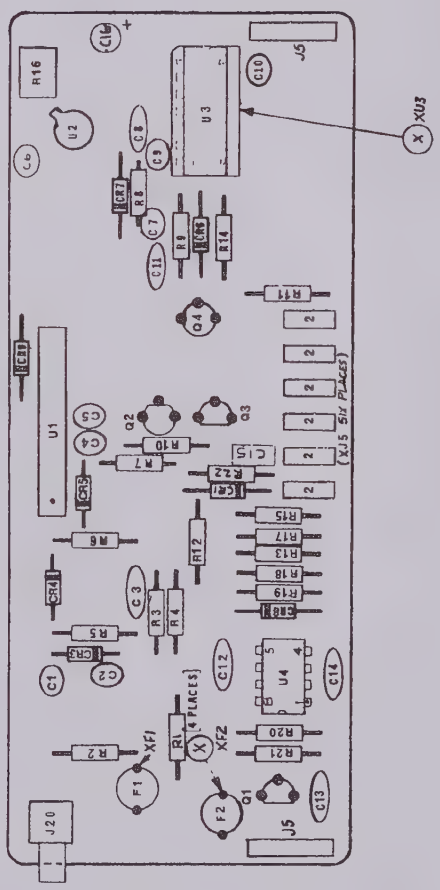


Figure 5-6. A4 520 MHz Prescaler PCB Assembly

Section 6
Option & Accessory Information

6-1. INTRODUCTION

6-2. This section of the manual contains information concerning the options and accessories available for use with the Model 1920A. It consists of an introductory section, an accessories subsection and a series of option subsections. All options and accessories are listed by model or option number in the table of contents. Corresponding subsection page numbers are also listed.

6-3. The location of a particular subsection is facilitated by the use of unique page and paragraph numbering which corresponds to the option or accessory in question. For example, a 600-x series identifies the general accessories subsection and a 605-x series identifies the subsection for the –05 option (where x is the sequential page or paragraph numbers).

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	ACCESSORIES	**600-1**
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–04	TCXO	604-1/604-2
–06	Multiplier Circuit	606-1
–13	1 GHz Prescaler	613-1
–14	1.25 GHz Prescaler	614-1

Accessories

600-1. INTRODUCTION

600-2. Table 600-1 list all available accessories for Model 1920A i.e., ordering part no. and nomenclature. Accessories available for the Model 1920A consist of Rack mount kit for mounting instrument in a standard 10-inch equipment rack, Extendable Whip Antenna (Figure 600-1) for HF Reception (50 MHz – 100 MHz @ 50Ω); and a variety of carrying cases.

Table 600-1. Model 1920A Accessories

Accessory No.	Description	J.F. Part No.
A53	Antenna, Extendable Whip (See Figure 600-1)	362762
C89	Case, Carrying	446803
M00-200-625	Rack Mount Kit	390468
2010A-7023	Printer Interface Kit	410472

600-3. RACK MOUNTING KIT (MOO-200-625)

600-4. Introduction

600-5. A rack mounting kit is available for mounting the 1920A in a standard 19-inch equipment rack. The rack mounting kit positions the 1920A in the center of the equipment rack.

600-6. Installation Procedure

600-7. Installation instructions for the rack mounting kit are presented below. Refer to Figure 600-2 while performing the steps of the mounting procedure.

1. Remove the handle disc decal and handle; retain the handle mounting screws.

2. Remove the instrument retaining screws (rear of the case) and remove the instrument from the case.

3. Insert the open end of the instrument case into the center rack mount plate until the case is flush with the front surface of the plate. Fasten the rack brackets and retainers to the case as shown.

4. Secure the brackets and retainers to the handle mounting bosses using the handle mounting screws. Take care to avoid stripping the threads.

5. Position the instrument case on the center rack mount plate and fasten the brackets using the 6-32 nuts.

6. Re-install the instrument in the case and replace the instrument retaining screw.

NOTE

Installation instructions will also be found in Section 2 of this manual.

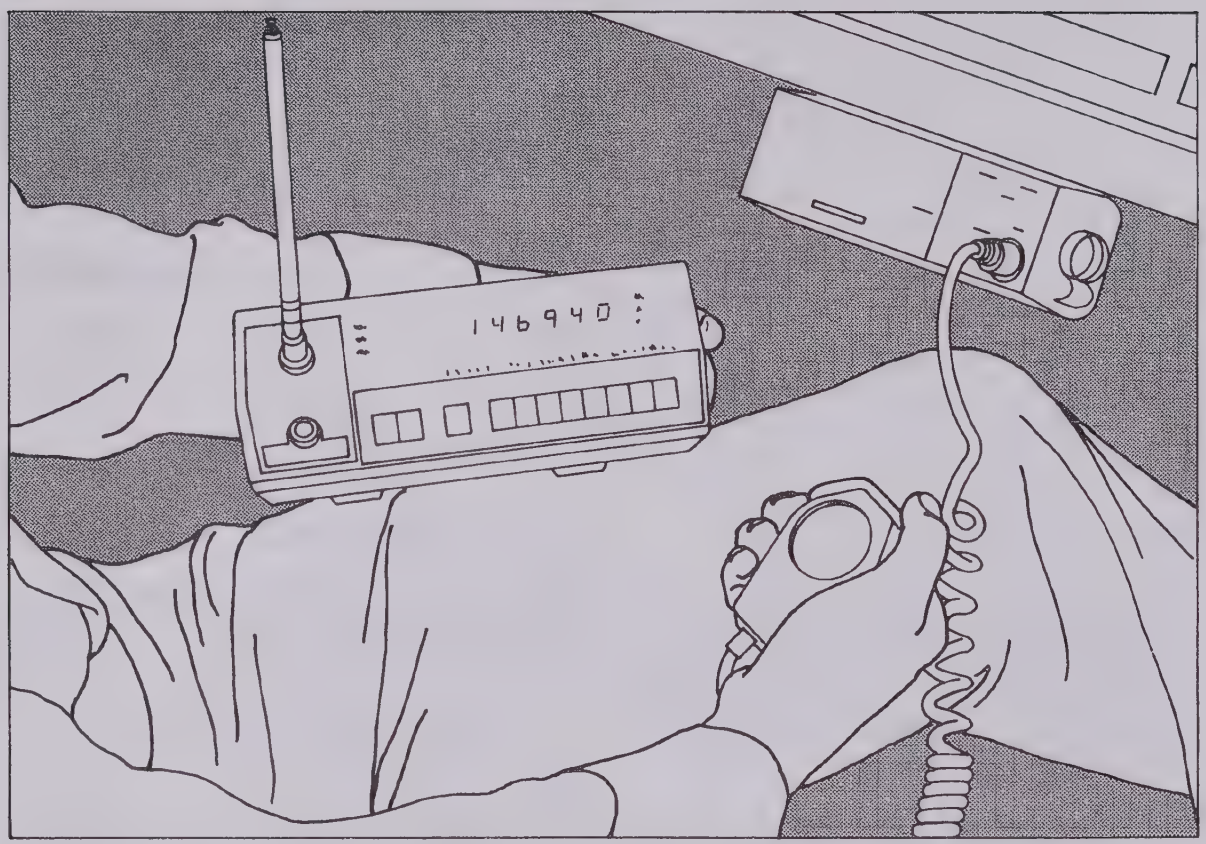

Figure 600-1. Extendable Whip Antenna

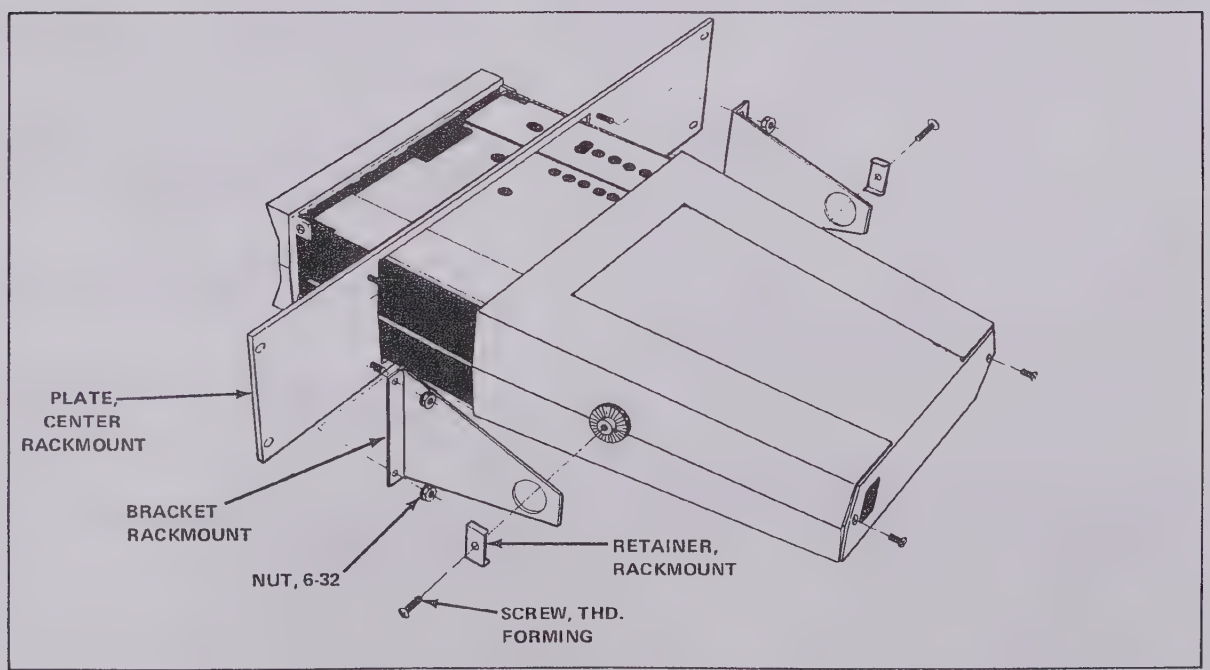

Figure 600-2. Rackmount Installation

Option —01
Rechargeable Battery

601-1. INTRODUCTION

601-2. Option —01 is a nickel-cadmium rechargeable unit with a discharge time of 3 hours (1.5 hrs when —13 or —14 Option installed). Charge time for the —01 Option is rated at a minimum of 14 hours with unit not operating. Charge current is rated at 400 ma with A/C input off, and 120 ma with A/C input on.

601-3. SPECIFICATIONS

601-4. Specifications of the —01 Option are located in Section 1 of this manual.

601-5. INSTALLATION

601-6. A line-powered version of the 1920A can be equipped with Option —01 (Field installable) by means of the 1920A-01K battery kit, provided the DOU option is not already installed. (The battery pack and DOU are mutually exclusive options.) To install the battery option, proceed as follows; referring to Figure 601-1.

1. Remove the unit from the case by loosening the retaining screws at rear.

2. Locate and remove the power supply shorting plug P7 (inserted in J6 on main PCB). Insert P7 into the vacant J7 and solder.

3. Remove the screws on the main assembly labeled 1 in Figure 601-1.

4. Connect P6 on the Battery PCB to J6 on the Main PCB observing correct orientation.

5. Pull left side chassis outwards and place left side of Battery PCB into groove in left side chassis.

6. Allow right side of Battery PCB to fit into groove in right side chassis.

7. Install screws labeled 1 and 2 and reinstall the unit into the case.

601-7. OPERATION

601-8. Power for the Model 1920A-01 is supplied by internal rechargeable batteries that will operate the instrument for at least three hours. Recharging is most rapidly accomplished by switching to OFF and connecting the instrument to the AC power line. In this way, the discharged batteries can be completely recharged in approximately 12 to 14 hours.

NOTE

Battery manufacturers recommend that nickel-cadmium batteries should not be stored for extended periods of time without recharging at least every 90 days. Storage temperatures below 25°C are recommended.

601-9. THEORY OF OPERATION

601-10. R6, R7, R8, CR3 and CR4 establish a reference voltage which is fed to one input of U1. (Refer to Figure 601-2.) The voltage drop across R5 is fed to the other input of U1. The output of U1 controls the charge current through Q5 and Q6. Q7 and Q8 turn on when the unit is operating to reduce the reference voltage and hence the charge current. Fuse (F1) protects the battery from short circuits.

601-11. Q1, Q2 and T1 form an oscillator that runs at about 5 kHz. The transformer outputs are rectified to provide 18V dc for 520 MHz operation and 12V dc for 1 GHz

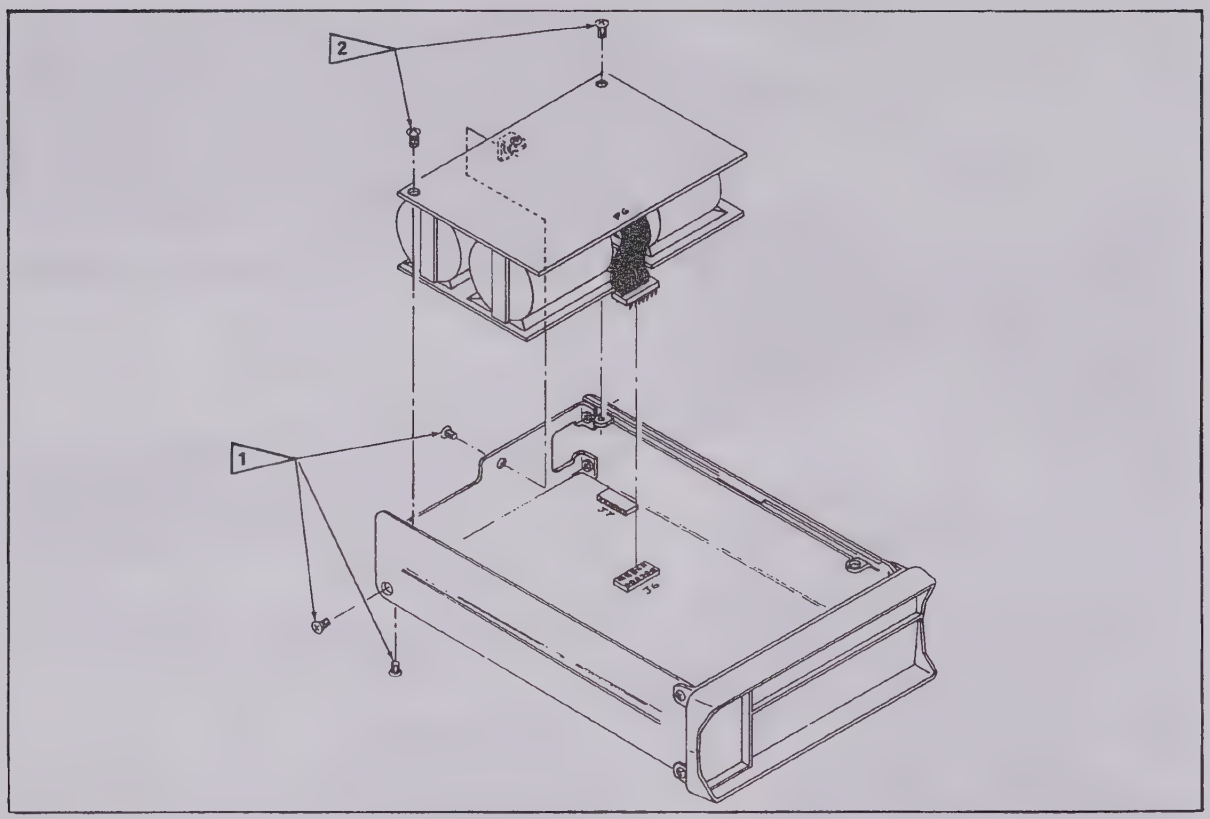

Figure 601-1 Battery Option Installation

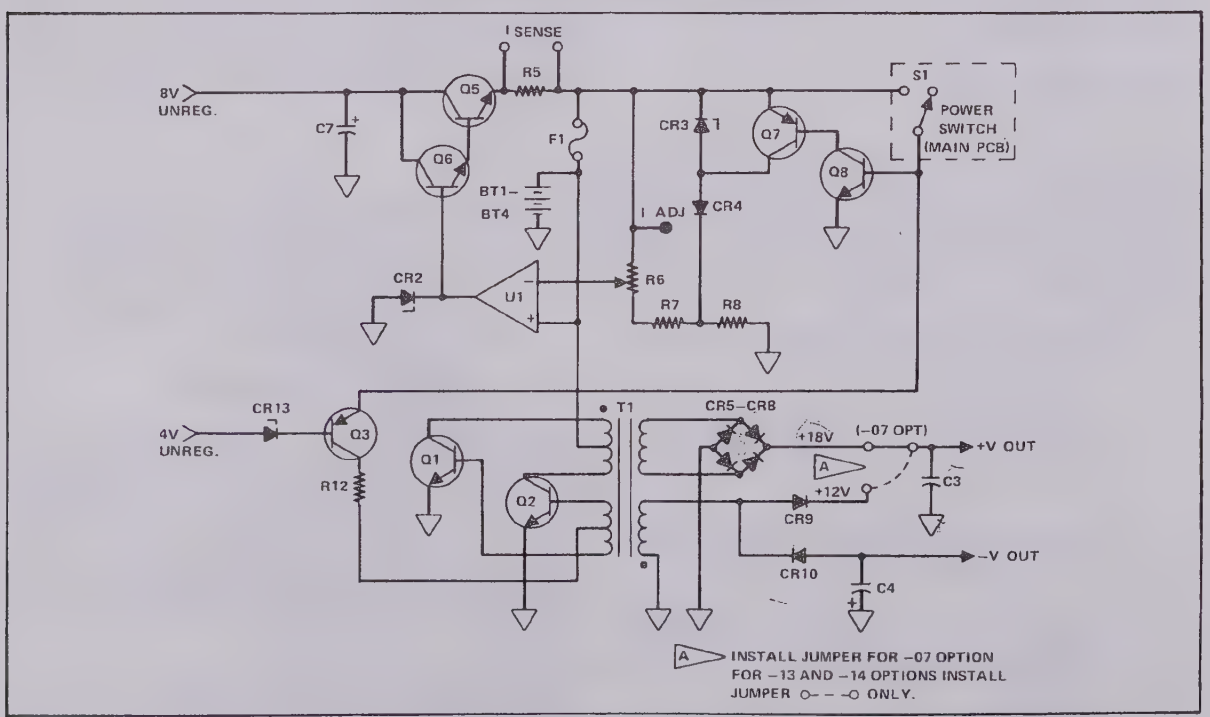

Figure 601-2. Battery Circuit, Simplified Schematic

(Option–13) or 1.25 GHz (Option–14) operation. Q3 provides a positive turn on bias to Q1 and Q2 when the system is operating from the AC power line.

601-12. CALIBRATION

601-13. This calibration procedure is intended to provide the checks and adjustments necessary to maintain proper instrument operation. Calibration should be performed when any corrective maintenance has been performed. Specifications for required test equipment and recommended models are presented in Table 4-1.

1. Remove 3A Fuse on Battery PCB Assy.

2. Set FREQUENCY to CHECK and RESOLUTION to 1 kHz.

3. Switch unit ON and measure the following voltages and currents.

TP6	+18V ±.9V
TP7	−12V ±1V

NOTE

Test points located on the Main PCB.

4. Check voltage at TP-8; it should be 6.5V max.

5. Switch unit OFF and replace 3A Fuse.

6. Connect a DVM across the I SENSE test points on the Battery PCB Assy.

7. With unit switch OFF apply line voltage within 3% of nominal (100V for 100V Option) and adjust IADJ trimpot (R6) for a voltage of 40 mV ± 2 mV.

601-14. MAINTENANCE

601-15. Battery Replacement

601-16. Follow the disassembly instruction below for removing the replaceable batteries in the Model 1920A-01.

1. Remove the unit from the case.

2. Remove the Battery PCB from the unit

NOTE

Reverse the Installation procedure steps 3-7.

3. Remove the two bolts securing the battery retainers in place.

4. Remove the top retainer and batteries.

5. Replace the batteries with 1.2 volt nickel-cadmium batteries (Fluke part no. 346925).

601-17. Fuse Replacement

601-18. The battery fuse is located on the battery pcb. When replacement is required install an AGC 3A (slow blow) fuse.

601-19. LIST OF REPLACEABLE PARTS

601-20. Table 601-1 is a list of replaceable parts for the battery option. The component locations are found on Figure 601-3

Table 601-1. Rechargeable Battery PCB Assembly, Option –01

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
–01	**RECHARGABLE BATTERY PCB ASSEMBLY (1920A-1217) Figure 601-3**						
BT1 thru BT4	Battery Nickel-Cadmium	346924	06001	41B004AD15	4		
C1, C2	Cap, Ta, 10 μF ±20%, 15V	193623	56289	196D106X-0015KA1	2		
C3	Cap, cer, 0.01 μF -20/+100, 40V	369579	72982	8121-A050-651-103Z	1		
C4	Cap, Ta, 10 μF ±20%, 35V	417683	56289	196D106X-0035PE4	1		
C5	Cap, cer, 0.1 μF ± GMV, 25V	369199	71590	UK-25-104	1		
C6	Cap, cer, 47 pF ±20%, 1000V	369132	56289	C030B102H-470J	1		
C7	Cap, Ta, 4.7 μF ±20%, 50V	363721	56289	196D475X-0050PE4	1		
CR1	Diode, Si, Rectifier	343491	07910	1N4002	1	1	
CR2	Diode, Zener, 8.2V	386771	07910	1N756A	1	1	
CR3	Diode, Zener, 3.3V	309799	07910	1N746A	2	1	
CR4 thru CR10	Diode, Hi-speed, switch	203323	07910	1N4448	7	2	
CR13	Diode, Zener, 3.3V	309799	07910	1N746A	REF		
F1	Fuse, fast acting, 3 amp	109199	71400	AGC3	1	5	
L1	Inductor, 6 turn (6160A-8002)	320911	89536	320911	1		
P6	Flat Cable Assembly	393520	08261	5142-006	1		
Q1, Q2,	Xstr, Si, NPN, pwr	407353	04713	2N5190	3	1	
Q3	Xstr, FET, Junction, P-channel	369652	89536	369657	2		

Table 601-1. Rechargable Battery PCB Assembly, Option –01 (cont)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
Q5	Xstr, Si, NPN, pwr	407353	04713	2N5190	REF		
Q6	Xstr, Si, NPN	218396	04713	2N3904	REF		
Q7	Xstr, FET, junction, P-channel	369652	89536	2X4061	REF		
Q8	Xstr, Si, NPN	218396	04713	2N3904	REF		
R1, R2	Res, comp, 2.2k ±5%, 1/4W	148049	01121	CB2225	2	1	
R3, R4	Res, comp, 27k ±5%, 1/4W	148148	01121	CB2735	3	1	
R5	Res, WW, pwr, 0.1 ±5%, 1/4W	404293	89536	404293	1	1	
R6	Res, var, cer, 10k ±20%, 0.20W	369553	54869	PT10H(2.5) 10K	1	1	
R7	Res, comp, 180k ±5%, 1/4W	193441	01121	CB1845	1	1	
R8	Res, comp, 10k ±5%, 1/4W	148106	01121	CB1035	1	1	
R9	Res, comp, 27k ±5%, 1/4W	148148	01121	CB2735	REF		
R10	Res, comp, 47k , ±5%, 1/4W	148163	01121	CB4735	1	1	
R11	Res, comp 10, ±5%, 1/4W	147868	01121	CB1005	1	1	
R12	Res, comp, 330, ±5%, 1/4W	147967	01121	CB3315	1	1	
T1	Xfmr, inverter	402198	89536	402198	1	1	
U1	IC, Lin, op amp	402750	12040	LM741CN	1	1	
XF1	Fuse, clip	284984	84613	3621-2	1	1	
1	Battery Contact	344200			8	2	
2	Battery Holder (8000A-2004)	390450	89536	390450	4	1	
3	Bracket, angle	416941	94223	073-010	1	1	
4	Lockwasher #4	110403	73734	1302	3	1	
5	Nut, Hex 4-40	110635	73734	8003NP	3	1	
6	Nut, Hex 6-32	110551	73734	8006NP	2	1	
7	Screw #4-40 x 3/8 PHP	152124	73734	19024	3	1	
8	Screw #6-32 x 2 3/16 PHP	347427	89536	347427	2	1	
9	Insulator, Xstr, mtg	412809	13103	43-77-8	1	1	

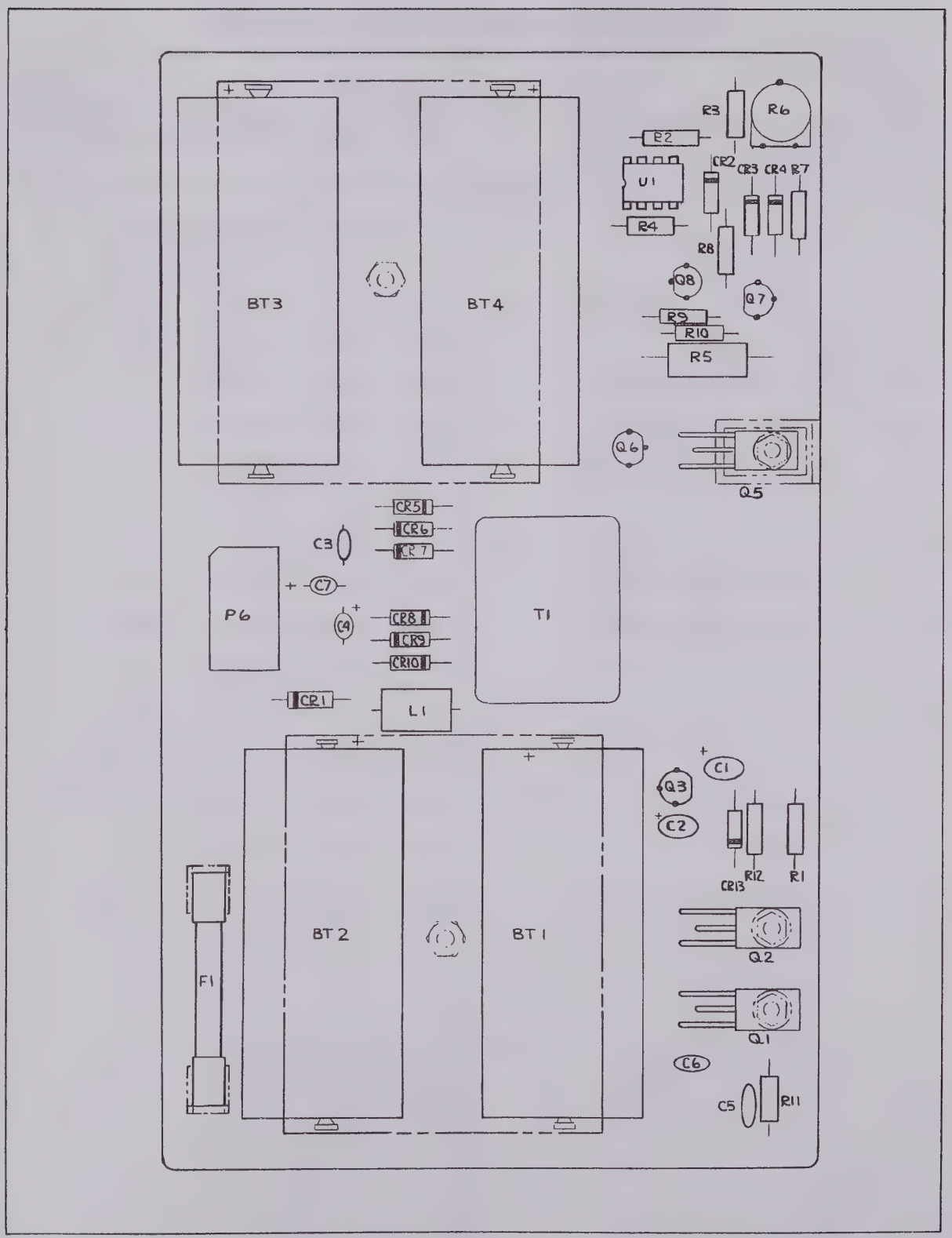

Figure 601-3. Rechargeable Battery PCB, Assembly

Option —02
Data Output Unit

602-1. INTRODUCTION

602-2. The Data Output Unit (DOU) permits the Model 1920A to operate in a system environment where electrical acquisition of the measurement data is necessary. The option comprises a single pcb-assembly which mounts within the 1920A case. This assembly provides all nine digits of measurement data (in BCD format), units indication, decimal point positioning and control signals to the external system by a pcb connector accessible through the rear panel. The DOU option may be ordered at the time of purchase or may be purchased at a later date and field-installed as described later in this section. The model number of the DOU when ordered as a field-installable kit is 1920A-02K.

602-3. The Digital Output Unit, as shown in Figure 602-1, contains ten latches U3-U6 and U8-U13. Nine of the latches are sequentially strobed with the nine digits of the readout. The tenth latch (U8) stores the decimal and overflow information. One half of U2 is used to strobe the decimal information into U8. The other half generates a print command every time the display memory is updated. The output of the DOU will thus change synchronors with the display.

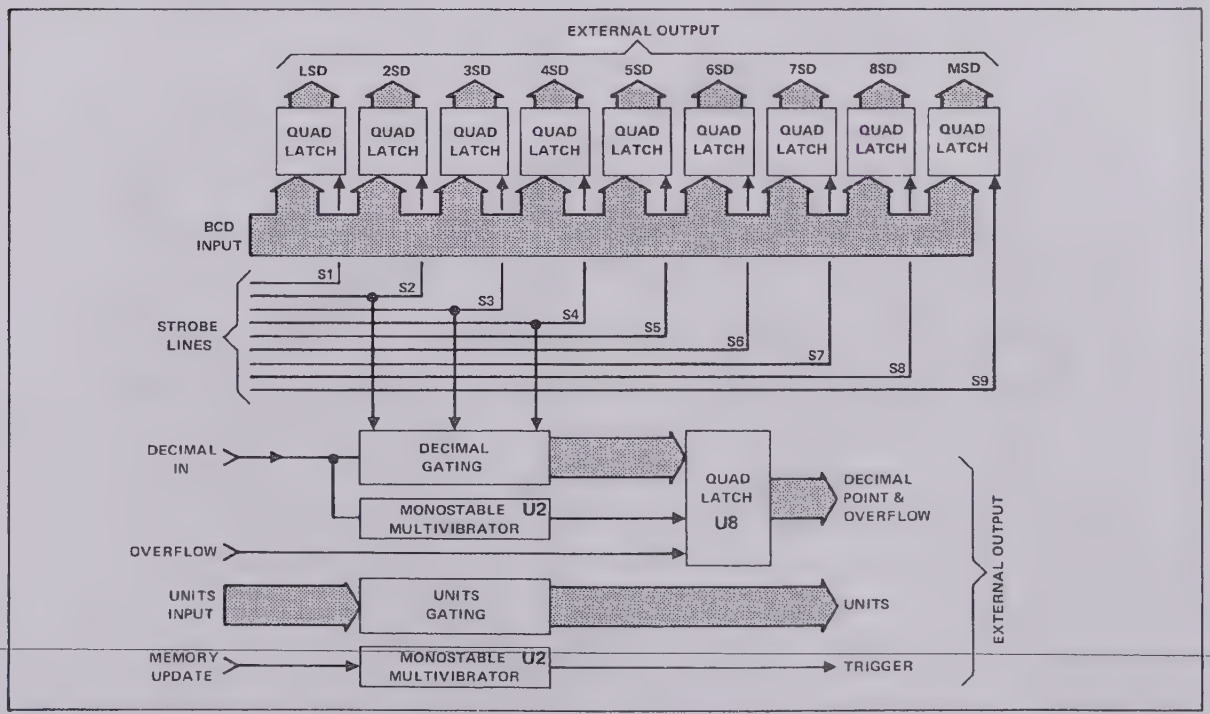

Figure 602-1. Data Output Unit, Block Diagram

602-4. SPECIFICATIONS

602-5. Specifications for the Data Output Unit are located in Section 1 of this manual.

602-6. INSTALLATION

602-7. The 1920A-02K DOU kit comprises the following items:

1. DOU pcb assembly.
2. Set of four stand-offs.
3. Mounting hardware.

602-8. Install the DOU as follows:

1. Remove the two screws that secure the outer case to the unit and remove the case.
2. Attach the four stand-offs to the under side (non-component side) of the DOU pcb.
3. Position the DOU down on the main pcb in the manor shown in Figure 602-2 so that the stand-offs align with the matching holes in the Main pcb.
4. Secure the DOU stand-offs to the Main pcb from the underside.
5. Connect cable P8 to J8 on the Main PCB and the three wires of J10 to the correspondingly numbered pins on the Display PCB.

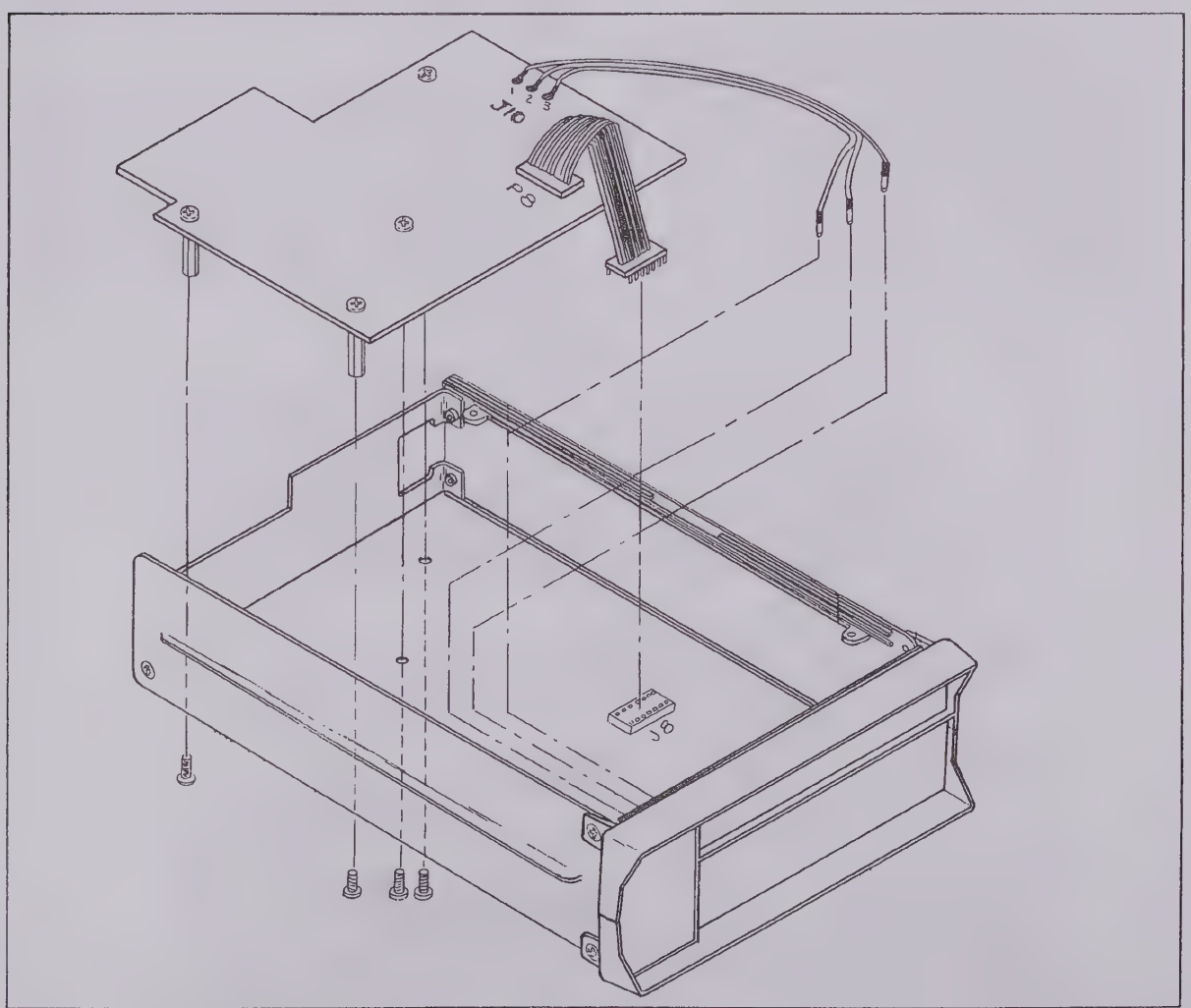

Figure 602-2. D.O.U. Installation Diagram

602-9. DOU I/O INFORMATION

602-10. The DOU output is available via the upper rear panel connector, labled BCD OUTPUT. The output data is in positive-true BCD format, CMOS compatible and is transferred to the external device by means of an interconnecting cable.

602-11. Loading of the signals at the recording device must be CMOS compatible. (Refer to Figure 602-3 for the particular pin assignments at the DOU output.) The DOU output connector (P30) is numbered/lettered from A to c from left to right (as viewed from the rear) on the top side of the pcb, and from 1 to 25 from left to right on the underside of the pcb. All data is positive-true CMOS compatible. The decimal point information is binary-coded to permit the nine different decimal point positions to be indicated on the three available output lines.

602-12. LIST OF REPLACEABLE PARTS

602-13. Table 602-1 is a list of replaceable parts for the Data Output Option. The component locations are illustrated in Figure 602-3.

Table 602-1. Data Output Unit PCB Assembly, Option –02

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
–02	**DATA OUTPUT UNIT PCB ASSEMBLY (1920A-1208) Figure 602-3**						
C1	Cap, Ta, 10 μF ±20%, 15V	193623	56289	196D106X 0015KA1	2		
C2	Cap, cer, 0.001 μF ±10%, 500V	357806	71590	CF102	1		
C3	Cap, Ta, 10 μF ±20%, 15V	193623	56289	196D106X 0015KA1	REF		
D8	Flat Cable Assembly	393520	08261	5142-006	1		
R1	Res, comp, 47k ±5%, 1/4W	148163	01121	CB4735	1		
R2	Res, comp, 10k ±5%, 1/4W	148106	01121	CB4735	1		
U1	⊗ IC, Dgtl, C-MOS, Quad 2-input NAND gates	355198	02735	CD4011AE	2	1	
U2	⊗ IC, Dgtl, C-MOS, Dual retriggerable/ resettable monostable multivibrator	393512	04713	MC14528CP	1	1	
U3 to U6	⊗ IC, Dgtl, COS/MOS, Quad, D latch	355149	02735	CD4042AE	10		
U7	⊗ IC, Dgtl, C-MOS, Quad, 2-input NAND gates	355198	02735	CD4011AE	REF		
U8 to U13	⊗ IC, Dgtl, COS/MOS, Quad, D latch	355149	02735	CD4042AE	REF		
	Cable Assembly (1920A-4411)	433656	89536	433656	1		
	Tie, cable, nylon	172080	06383	SST-1M	1		
	Lockwasher no. 6 I.T. (not illustrated)	110338	73734	1304	4		
	Screw, PNH, PHP, 6 - 32 x 1/4 (not illustrated)	152140	73734	19042	4		
	Spacer, hex, 6 - 32 x 3/8 (not illustrated)	442640	89536	442640	4		

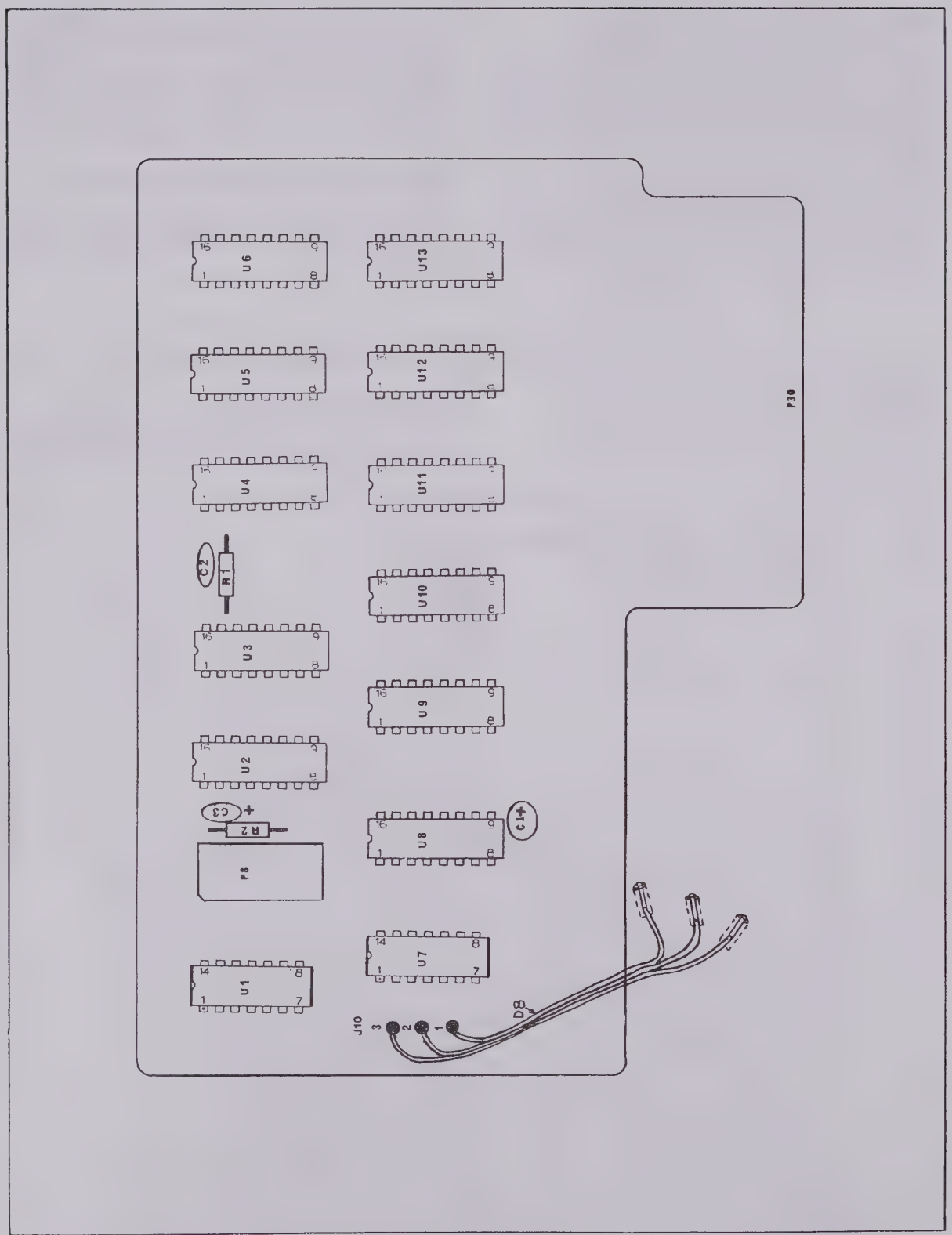

Figure 602-3. Data Output Unit PCB, Assembly

Option —04
TCXO

604-1. INTRODUCTION

604-2. Option —04 is a Temperature Compensated Crystal Oscillator (TCXO) which exhibits stability and temperature dependent characteristics which are superior to the oscillator normally installed in the standard unit. This option must be installed by the factory.

604-3. SPECIFICATIONS

604-4. Table 604-1 gives specification for option —04 Superior TCXO and Standard TCXO.

Table 604-1. Timebase Stability

	Standard	—04 Option
Frequency:	10.00 MHz	10.00 MHz
Aging Rate (per month):	$<\pm 3 \times 10^{-7}$	$<\pm 3 \times 10^{-7}$
Temperature Stability:		
0 - 50°C	$<\pm 2 \times 10^{-6}$	$<+5 \times 10^{-7}$
20 - 30°C	$\pm 5 \times 10^{-7}$ typ	$\pm 2 \times 10^{-7}$ typ
Line Voltage (±10% change)	$<\pm 1 \times 10^{-7}$	$<\pm 5 \times 10^{-8}$

Option —06
Multiplier Circuit

606-1. INTRODUCTION

606-2. The multiplier circuit is used in the high resolution mode of operation to increase the frequency of the input signal by a factor of 10^3, thereby permitting shorter gate times during low frequency measurements. When the high resoltuion mode is not selected on the front panel switch power is removed, and the entire circuit is disabled and consequently provides no output.

606-3. SPECIFICATIONS

606-4. Specifications for the multiplier circuit are located in Section 1 of this manual.

606-5. INSTALLATION

606-6. The resolution multiplier option may be ordered by option number only. The option must be installed by the factory at the time of purchase.

606-7. OPERATION

606-8. In order to make rapid measurement of low frequency signals, a high resolution mode of operation is available which allows the use of shorter gate times to speed-up measurement cycles. For example, a low frequency tone being measured with a resolution of 0.1 Hz would normally require a gate time of ten seconds. To adjust the frequency of the tone while observing the counter could be extremely difficult due to the time lag between the adjustment and the resultant display on the counter. The high resolution mode eliminates the problem by multiplying the input signal by a factor of 1000, which allows a shorter gate time to be selected. In this mode, 0.1 Hz resolution is obtained by pressing the 100 Hz switch to select a gate time of 10 milliseconds.

NOTE

The RESOLUTION switches each select resolutions which are finer by a factor of 10^{-3} due to the multiplication of the input by 10^3 for a given gate time. That is 1 kHz resolution becomes 1 Hz resolution, 100 Hz becomes 0.1 Hz, etc.

606-9. To operate in the high resolution mode, proceed as follows:

1. Connect a 10Hz to 10 kHz input signal to the lower front panel BNC connector.
2. Press the 10 Hz to 10 kHz X1000 switch.
3. Select the desired resolution. Note that the resolution is increased by a factor of 10^3.
4. Read the measurement on the display and note the unit of measurement (i.e. kHz or Hz).

NOTE

If the UNLK lamp lights or flashes while the display reads zero, the upper (10 kHz) or lower (10 Hz) frequency limit of the input multiplier has probably been exceeded.

606-10. THEORY OF OPERATION

606-11. Figure 606-1 shows that the input signal is fed from the direct preamplifier to one input of a digital frequency phase comparator. The second input to the comparator receives the actual output of the multiplier circuit after being divided by a factor of 10^3. When the output of the multiplier is exactly 1000 times greater than the input from the direct preamplifier, the two comparator inputs are

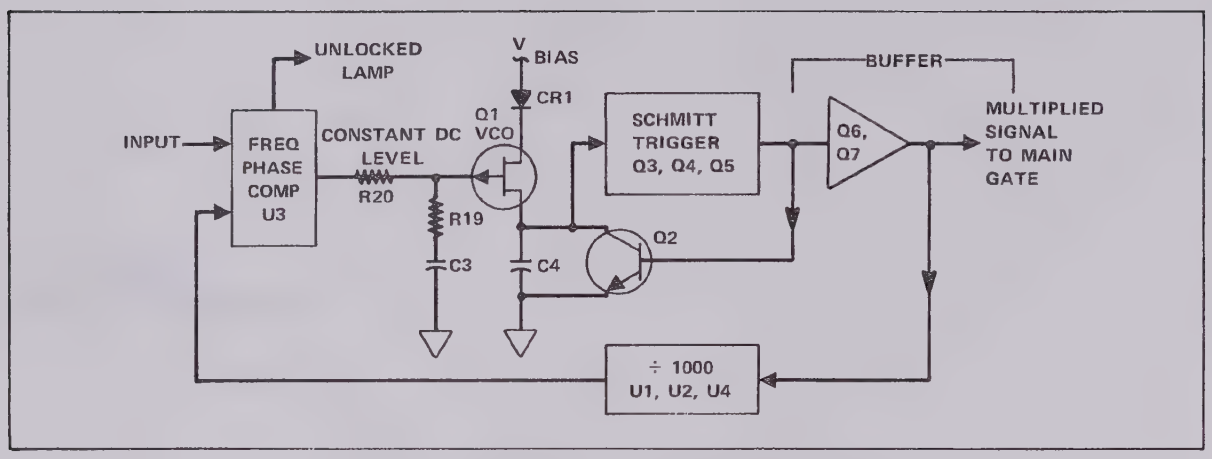

Figure 606-1. Multiplier Circuit, Simplified Schematic Diagram

in phase and a constant DC level is present at the VCO input. The comparator output, filtered by R19, R20, and C3, drives Q1 and controls the charging rate of C4 through CR1. The voltage across C4 is applied to the input of a Schmitt trigger (which changes state at some threshold point). The Schmitt trigger causes Q2 to discharge C4, to begin the action over again.

606-12. The output of the Schmitt trigger is buffered by Q6 and Q7 (NPN type) and fed to the Main Gate and decade counters. The output is also divided by 1000 and fed back for comparison with the input from the direct preamplifier to form a phase-locked loop. Any frequency or phase difference between the two inputs will cause the output to change to maintain multiplied output equal to 1000 times the input. The phase comparator also provides a DC output to light the unlock lamp and reset the counters whenever the multiplier is not locked in phase. This condition occurs during start-up or when an invalid input is present at the multiplier.

606-13. LIST OF PARTS

606-14. Table 606-1 is a list of replaceable parts for the resolution multiplier option. The component locations are found on Figure 606-2

Table 606-1. Resolution Multiplier PCB Assembly, Option –06

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
–06	**Resolution Multiplier PCB Assembly, (1920A-1206) Figure 606-2**						
C1	Cap, Ta, 10 μF ±20%, 15V	193623	56289	196D106X-0015KA1	4		
C2	Cap, cer, 0.1 μF ± GM5, 50V	369199	71590	UK-25-104	2		
C3	Cap, Ta, 10 μF ±20%, 15V	193623	56289	196D106X-0015KA1	REF		
C4	Cap, cer, 22 pF ±20%, 500V	369157	72982	831-000-COGO-220	1		
C5	Cap, cer, 0.1 μF ± GMV, 50V	369199	71590	UK-25-104	REF		
C6	Cap, Ta, 10 μF ±20%, 15V	193623	56289	196D106X-0015KA1	REF		
C7	Cap, cer, 1000 pF ±10%, 500V	357806	71590	CF-102	1		
C8	Cap, Ta, 10 μF ±20%, 15V	193623	56289	196D106X-0015KA1	REF		
Q1	Xstr, FET, P-channel	403600	89536	403600	1	1	
Q2	Xstr, Si, NPN	369645	07910	2N4274	3	1	
Q3	Xstr, FET, Dual, N-channel	379271	89536	379271	1	1	
Q4, Q5	Xstr, Si, PNP	369629	07263	2N5771	2	1	
Q6, Q7	Xstr, Si, NPN	369645	07910	2N4274	REF		
Q8, Q9	Xstr, Si, NPN	218396	04713	2N3904	2	1	
Q10	Xstr, Si, PNP	352369	07263	2N4403	1	1	
R1, R2	Res, comp, 2k ±5%, 1/4W	170720	01121	CB2025	3		
R3	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	6		
R4	Res, comp, 22k ±5%, 1/4W	148130	01121	CB2235	1		
R5	Res, comp, 560 ±5%, 1/4W	147991	01121	CB5615	1		
R6, R7	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	REF		
R8	Res, comp, 1M ±5%, 1/4W	182204	01121	CB1055	1		
R9	Res, comp, 470k ±5%, 1/4W	188441	01121	CB4745	1		

Table 606-1. Resolution Multiplier PCB Assembly, Option –06 (cont)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R10	Res, comp, 180 ±5%, 1/4W	147942	01121	CB1815	1		
R11	Res, comp, 39 ±5%, 1/4W	147975	01121	CB3915	2		
R12	Res, comp, 150 ±5%, 1/4W	147934	01121	CB1515	1		
R13	Res, comp, 820 ±5%, 1/4W	148015	01121	CB8215	1		
R14	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	REF		
R15	Res, comp, 1.2k ±5%, 1/4W	190371	01121	CB1225	1		
R16	Res, comp, 350 ±5%, 1/4W	147975	01121	CB3915	REF		
R17	Res, comp, 220 ±5%, 1/4W	147959	01121	CB2215	1		
R18	Res, comp, 2k ±5%, 1/4W	170720	01121	CB2025	REF		
R19	Res, comp, 3.3k ±5%, 1/4W	148056	01121	CB3325	1		
R20	Res, comp, 100k ±5%, 1/4W	148189	01121	CB1045	1		
R21	Res, comp, 27k ±5%, 1/4W	148148	01121	CB2735	1		
R22, R25	Res, comp, 1k ± 5%, 1/4W	148023	01121	CB1025	REF		
R23, R24	Res, comp, 4.7k ± 5%, 1/4W	148072	01121	CB4725	2		
U1, U2	IC, Dgtl, TTL MSI, decade counter	402545	01295	SN74LS90N	2	1	
U3	IC, Lin, COS/MOS phase locked loop	403584	02735	CD4046AE	1	1	
U4	IC, Dgtl, TTL, 30 MHz, presettable decade	393256	01295	SN74LS196N	1	1	
U5	IC, TTL, Hex Inverter, buffer/driver	288605	01295	SN7416N	1	1	
U6	IC, Lin, pos V-reg	408138	04713	78L12WC	1	1	
1	Conn, Jack, PCB mnt	149112	74970	105-0753	2		
2	Conn, recpt	375329	00779	85863-3	7		

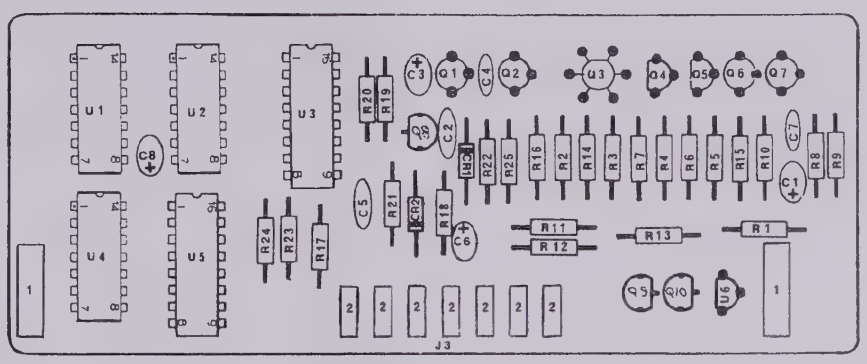

Figure 606-2. Resolution Multiplier PCB Assembly

Option —13
1 GHz Prescaler

613-1. INTRODUCTION

613-2. The HF counter input of the Model 1920A is intended for use with an operational frequency-prescaler. Option –13 is a prescaler which extends the operation of the counter 1 GHz. This prescaler has a frequency range of 50 MHz to 1 GHz at a specified sensitivity of 15 mVrms.

613-3. INSTALLATION

613-4. The option is comprised of a plug-in assembly, and a jumper change to compensate the counter circuitry for the prescaling divisor. The option must be ordered factory installed in the 1920A when the instrument is purchased, it is not field installable.

613-5. OPERATION

613-6. Operation of the 1920A counter in the 1 GHz Prescaler mode is accomplished by selecting the "50 MHz-1000 MHz" input BNC connector in conjunction with the selection of the appropriate "piano-key" front panel actuator switch. Both actuator and BNC connector are ear-marked with yellow color code for simple identification. (Overload protection is provided by a pcb mounted 2/10A fuse.)

613-7. THEORY OF OPERATION

613-8. The main function of the 1 GHz Prescaler is to reduce the input signal to below 130 MHz for application to the main gate decade counters. The prescaler also provides the necessary conditioning of the input signal to provide sufficient gain and the proper waveshaping. The frequency division factor for the 1 GHz Prescaler is eight.

613-9. As shown in Figure 613-1 the input signal is fed through an input protection fuse (F1) to the input of the amplifier U1 (input limiter). The output of the amplifier, which is also internally limited, is applied to a divider circuit which divides by a factor of eight to reduce the input frequency to below 130 MHz. The prescaled signal, amplified by U1 and divided by U2 and U3 is fed to the Main PCB assembly for application to the main gate decade counters.

613-10. The output of amplifier U1 is sensed thru CR1 and U4, to detect signals whose level is too low to reliably clock the divider circuit. When a low signal is detected, the divider output is disabled and a signal is provided to the Main PCB preventing the gate from opening, causing the display to read zero. This signal is also used in the Burst mode to detect burst signals.

NOTE

The prescaler like the Direct Preamplifier is energized only when that mode is selected. When not selected the front panel mode switch interrupts its power supply connection.

613-11. MAINTENANCE

613-12. Performance Checks

613-13. The performance check of the Model 1920A is actually a sensitivity check made at the upper and lower frequency limits. Proceed as follows:

1. Connect a High Frequency Generator and AC/rms voltmeter with high impedance probe to the input.
2. Set input frequency to 50 MHz at 15 mVrms.
3. Reduce input level until input level becomes unstable then slowly increase level until display becomes stable and correct.
4. Note that the input voltage is less than 15 mV.

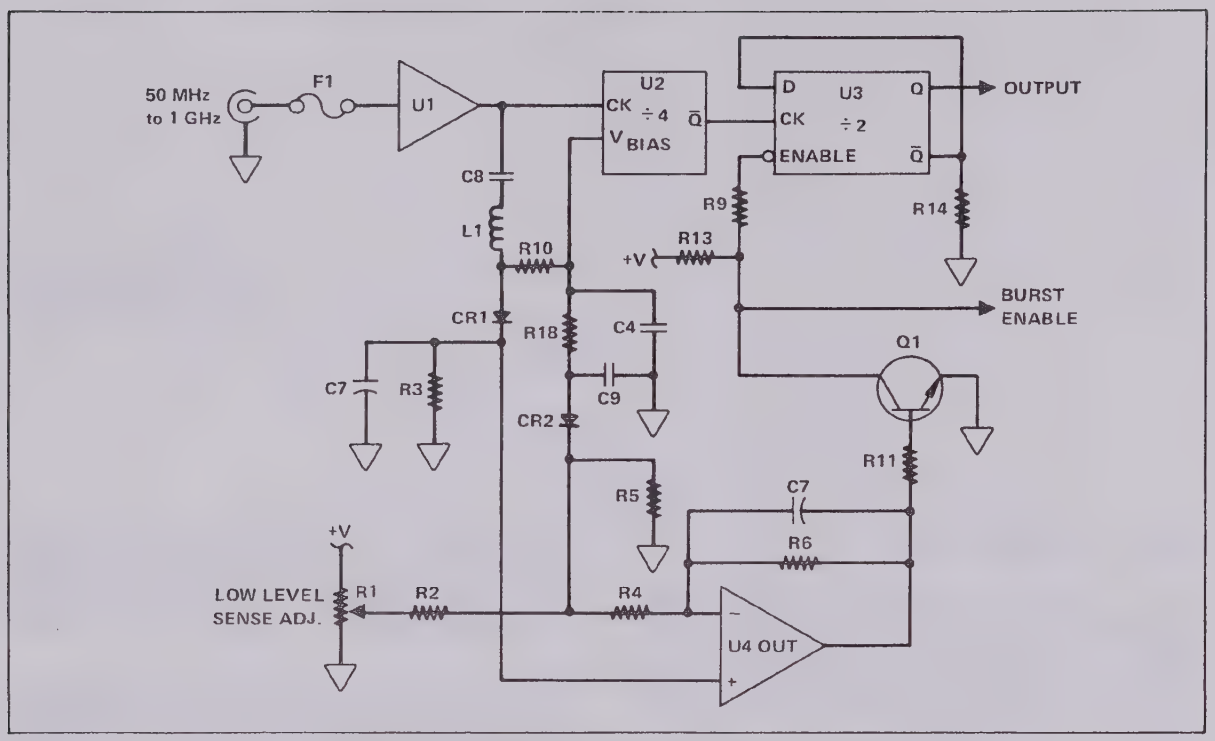

Figure 613-1. 1 GHz Prescaler, Simplified Schematic Diagram

5. Set input frequency to 100 MHz at 15 mVrms.

6. Reduce input level until display reads zero. The signal level should be less than 15 mV rms.

7. Repeat step 5 and 6 every 100 MHz to 1000 MHz.

8. Sweep the generator frequency from 50 MHz to 1000 MHz at 15 mV rms. Check for stable and correct display at all frequencies.

613.14. Calibration

613-15. Calibration of the 1 GHz Prescaler amounts to adjustment of the low level sense control located on the top edge of the Prescaler pcb assembly. Proceed as follows:

1. Connect a high frequency generator and AC rms voltmeter with high impedence probe to the counter input.

2. Set the cutout trimpot (R1) to the maximum clockwise position.

3. Adjust the input frequency for 50 MHz at 15 mV rms.

4. Reduce the input level until the 1920A display becomes unstable, then slowly increase level until the display becomes stable and correct.

5. Advance the cutout trimpot (R1) slowly until the the display reads zero.

6. Note that the input level is less than 13 mV rms.

7. Slowly increase the input level until the display correctly reads the input frequency. The difference in level should be 1 or 2 mV.

8. Set the input frequency to 1 GHz at 15 mV rms.

9. Reduce input level until display reads zero. If display becomes unstable before going to zero repeat 4 and 5.

10. Sweep the generator from 40 MHz to 1000 MHz at 15 mV rms. Check for stable and correct display at all frequencies.

613-16. LIST OF REPLACEABLE PARTS

613-17. Table 613-1 is a list of replaceable parts for the 1 GHz prescaler. Refer to Section 5 for explanation of columnar entries. The component locations are illustrated in Figure 613-2.

Table 613-1. 1 GHz Prescaler PCB Assembly, Option –13

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
–13	**1 GHz PRESCALER PCB ASSEMBLY (1953A-1227) Figure 613-2**						
C1 thru C6	Cap, cer, 0.001 μF ±20%, 100V	402966	71590	8121-A100-W5R-102M	8		
C7	Cap, cer, 0.001 μF ±10%, 500V	357806	71590	CF102	1		
C8, C9	Cap, cer, 0.001 μF ±20%, 100V	402966	71590	8121-A100-W5R-102M	REF		
C10	Cap, cer, 0.001 μF 10%, 500V	357806	71590	CF102	REF		
C11	Cap, Ta, 10 μF ±20%, 15V	193626	56289	196D106X 0015KA1			
CR1, CR2	Diode, Hot-carrier	369595	07263	FH1100	2	1	
F1, F2	Fuse, 2/10 amp	370577	75915	273200	2	10	
J20	Connector, coax	353243	98291	51.053.000	1		
L1	Coil, Ferrite bead	321182	02114	56-590-65-4B	1		
Q1	Xstr, Si, NPN	218396	04713	2N3904	2	1	
Q2	Xstr, Si, PNP	352369	07263	2N4403	1	1	
Q3	Xstr, Si, NPN	218396	04713	2N3904	REF		
R1	Res, var, car, comp, trimmer, 10k ± 20%	385393	54869	PT-10H(2.5) 10K	1		
R2	Res, comp, 330k ±5%, 1/4W	192948	01121	CB3345	2		
R3	Res, comp, 2.7k ±5%, 1/4W	170720	01121	CB2725	4		
R4	Res, comp, 10k ±5%, 1/4W	148106	01121	CB1035	2		
R5	Res, comp, 2.7k ±5%, 1/4W	170720	01121	CB2725	REF		
R6	Res, comp, 330k ±5%, 1/4W	192948	01121	CB3345	REF		
R7, R8	Res, comp, 470, ±5%, 1/4W	147983	01121	CB4715	3		
R9	Res, comp, 4.7k ±5%, 1/4W	148072	01121	CB4725	1		
R10	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	3		
R11	Res, comp, 10k ±5%, 1/4W	148106	01121	CB1035	REF		
R13	Res, comp, 2.7k ±5%, 1/4W	170720	01121	CB2725	REF		
R14	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	REF		

Table 613-1. 1 GHz Prescaler PCB Assembly, Option –13 (cont)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R15	Res, comp, 470 ±5%, 1/4W	147983	01121	CB4715	REF		
R16	Res, comp, 51 ±5%, 1/8W	266262	01121	BB5101	1		
R17	Res, comp, 2.7k ±5%, 1/4W	170720	01121	CB2725	REF		
R18	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	REF		
R19	Res, comp, 1.5M ± 5%, 1/4W	349001	01121	CB1555	1		
U1	IC, Hybrid, 1250 MHz	428797	31091	CA1044			
U2	IC, Fallout, 11C05	444034	89536	444034	1	1	
U3	IC, TTL, D-type	404574	07263	F11C06DC	1	1	
U4	IC, op-amp	402750	12040	LM741CN	1	1	
XU1	Socket, miniature	403642	00779	50863-B	28		
XU2	Socket, IC, 1p, 14 pin	291542	00779	583527-1	1		
XU3	Socket, IC, 1p, 16 pin	370312	00779	C931602	1		
1	Cable Assembly (not illustrated)	406942	89536	406942	1		
2	Connector, test jack	149112	74970	105-0753	2		
3	Decal, 1000 MHz (not illustrated)	428037	89536	428037	1		
4	Connector, receptacle	375329	00779	85863-3	1		

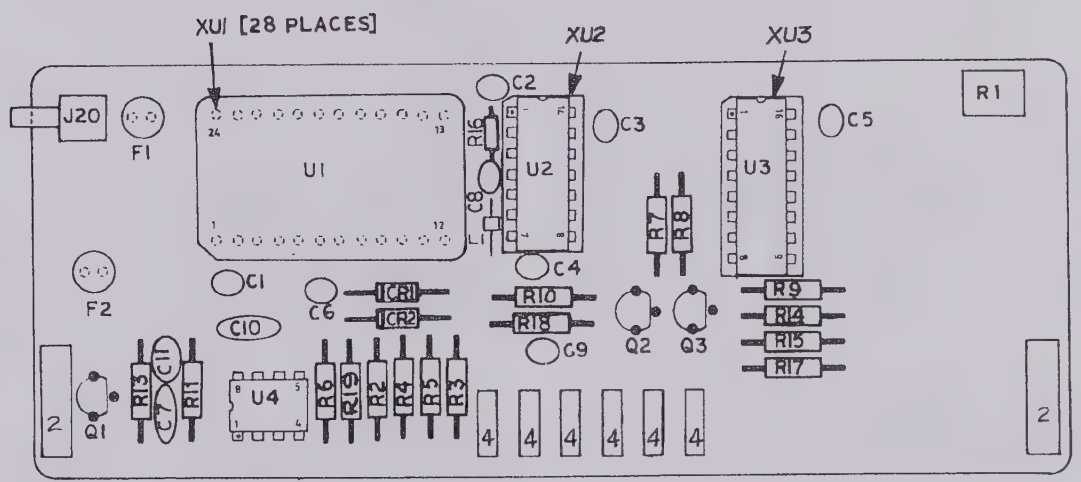

Figure 613-2. 1 GHz Prescaler PCB, Assembly

Option —14
1.25 GHz Prescaler

614-1. INTRODUCTION

614-2. The HF counter input of the Model 1920A is intended for use with an operational frequency-prescaler. Option –14 is a prescaler which extends the operation of the counter to 1.25 GHz. This prescaler has a frequency range of 50 MHz to 1.25 GHz at a specified sensitivity of 15 mV rms, from 50 MHz to 1 GHz decreasing to 30 mV rms between 1 GHz and 1.25 GHz.

614-3. INSTALLATION

614-4. The option is comprised of a plug in pcb assembly, and a jumper change to compensate the counter circuitry for the prescaling divisor. The option must be ordered factory installed in the 1920A when the instrument is purchased, it is not field installable.

614-5. OPERATION

614-6. Operation of the 1920A counter in the 1.25 GHz Prescaler mode is accomplished by selecting the "50 MHz-1250 MHz" input BNC connector in conjunction with the selection of the appropriate "piano-key" front panel actuator switch. Both actuator and BNC connector are earmarked with yellow color code for simple identification. (Overload protection is provided by a pcb mounted, 2/10A fuse.)

614-7. THEORY OF OPERATION

614-8. The main function of the 1.25 GHz Prescaler is to reduce the input signal to below 160 MHz for application to the main gate decade counters. The prescaler also provides the necessary conditioning of the input signal to provide sufficient gain and the proper waveshaping. The frequency division factor for the 1.25 GHz Prescaler is eight.

614-9. As shown in figure 614-1, the input signal is fed through an input protection fuse (F1) to the input of the amplifier U1 (input limiter). The output of the amplifier, which is also internally limited, is applied to a divider circuit which divides by a factor of eight to reduce the input frequency to below 160 MHz. The prescaled signal, amplified by U1 and divided by U2 and U3 is fed to the Main PCB Assembly for applicaton to the main gate decade counter.

NOTE

In the "1 GHz - 1.25 GHz Prescaler", the additional division is by a factor of eight. For example, the time base division factor of 8 x 10^4, 125 Hz or 8 msec, 8 x 10^5, 12.5 Hz, or 80 msec, etc.

614-10. The output of amplified U1 is sensed thru CR1-U4, to detect signals whose level is too low to reliably clock the divider circuit. When a low signal is detected, the divider output is disabled and a signal is provided to the Main PCB preventing the gate from opening, causing the display to read zero. This signal is also used in the Burst mode to detect burst signals.

614-11. MAINTENANCE

614-12. Performance Checks

NOTE

The prescaler like the Direct Preamplifier is energized only when that mode is selected. When not selected the front panel mode switch interrupts its power supply connection.

614-13. The performance check of the Model 1920A is actually a sensitivity check made at the upper and lower frequency limits. Proceed as follows:

1. Connect a high frequency generator and AC/rms voltmeter with high impedance probe to the input.

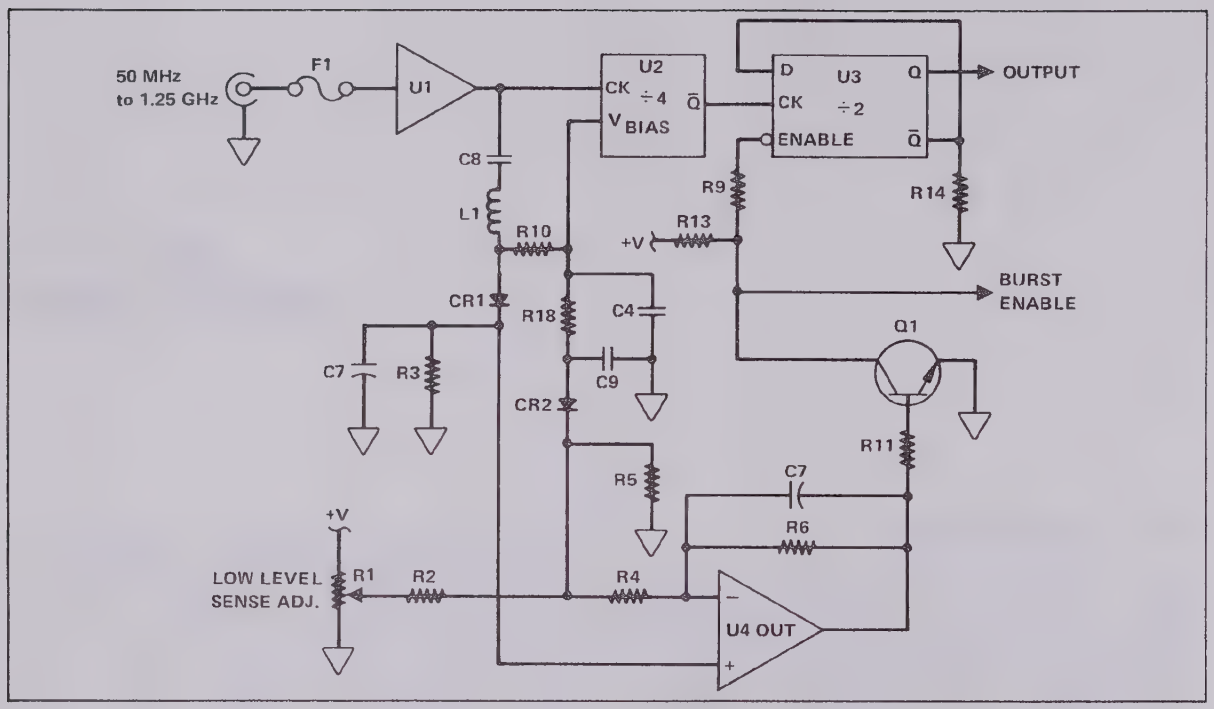

Figure 614-1. 1.25 GHz Prescaler PCB Simplified Schematic Diagram

2. Adjust the input frequency for 50 MHz at 15 mV rms.

3. Reduce the input level until the display becomes unstable then slowly increase the level until the display becomes stable and correct.

4. Note that the input voltage is less than 15 mV. Slowly increase input level until display again reads the frequency.

5. Adjust the input frequency for 100 MHz at 15 mV rms.

6. Reduce input level until display reads sero. The display should not become unstable before going to zero.

7. Repeat step 5 and 6 every 100 MHz to 1000 MHz.

8. Sweep generator for 40 MHz to 1000 MHz at 15 mV rms. Check for stable and correct display at all frequencies.

9. Adjust the input frequency for 1100 MHz at 25 mV rms. Reduce input level until display reads zero. The display should not become unstable before it reads zero.

10. Repeat step 9 at 1200 MHz and 1225 MHz at 25 mV rms.

614-14. CALIBRATION

614-15. The calibration procedure described below is intended to provide the checks and adjustments necessary to maintain proper instrument operation. This procedure should be performed whenever the instrument fails to meet the requirements of the performance check or whenever repairs are completed. The required test equipment is presented in Table 4-1.

614-16. Perform the calibration procedure as follows:

1. Connect a high frequency generator and AC/rms voltmeter with high impedance probe to the counter input.

2. Set cutout trimpot (R1) to maximum clockwise position.

3. Set input frequency to 50 MHz at 15 mV rms.

4. Reduce input level until the display becomes unstable. Slowly increase the level until display becomes stable and correct.

5. Advance cutout trimpot (R1) slowly counterclockwise until the display reads zero. The input level should be less than 25 mV.

6. Adjust the input frequency for 100 MHz at 15 mV rms.

7. Reduce input level until display reads zero. If display becomes unstable before going to zero repeat 4 and 5.

8. Repeat 6 and 7 for inputs at 100 MHz intervals to 1000 MHz.

9. Sweep generator from 40 MHz to 1 GHz at 15 mV rms. Check for a stable and correct display at all frequencies.

10. Set input frequency to 1.1 GHz at 25 mV rms. Reduce input level until display reads zero. If display becomes unstable before going to zero. Repeat 4 and 5.

11. Repeat 10 at 1200 and 1250 MHz.

12. Sweep generator from 1000 MHz to 1260 MHz at 25 mV rms. Check for a stable and correct display at all frequencies.

614-17. LIST OF REPLACEABLE PARTS

614-18. Table 614-1 is a list of replaceable parts for the 1.25 GHz prescaler. Refer to Section 5 for an explanation of the columnar entries. The component locations are illustrated in Figure 614-2.

Table 614-1. 1.25 GHz Prescaler PCB Assembly, Option –14

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
–14	1.25 GHz PRESCALER PCB ASEMBLY (1953A-1228) Figure 614-2						
C1 thru C6	Cap, cer, 0.001 μF	402966	71590	8121-A100-W5	8		
C7	Cap, cer, 0.001 μF ±10%, 500V	357806	71590	CB102	1		
C8, C9	Cap, cer, 0.001 μF	402966	71590	8121-A100-W5	REF		
C10	Cap, cer, 0.001 μF ±10%, 500V	357806	71590	CB102	REF		
C11	Cap, Ta, 10 μF ±20%, 15V	193626	56289	196D106X 0015KA1			
CR1, CR2	Diode,	369595	07263	GH1100	2		
F1, F2	Fuse, 2A	370577	75915	273.200	2		
J20	Connector, coax	353243	98291	51.053.000	1		
L1	Coil, Ferrite Bead	321182	02114	56-590-65-4B	1		
Q1	Xstr, Si, NPN, sm/sig	218396	04713	2N3904	2		
Q2	Xstr, Si, PNP, sm/sig	352369	07263	2N4403	1		
Q3	Xstr, Si, NPN, sm/sig	218396	04713	2N3904	REF		
R1	Res, 10k ±20%	385393	54869	PT-10H-10K	1		
R2	Res, comp, 330k ±5%, 1/4W	192948	01121	CB3345	2		
R3	Res, comp, 2.7k ±5%, 1/4W	170720	01121	CB2725	4		
R4	Res, comp, 10k ±5%, 1/4W	148106	01121	CB1035	2		
R5	Res, comp, 2.7k ±5%, 1/4W	170720	01121	CB2725	REF		
R6	Res, comp, 330k ±5%, 1/4W	192948	01121	CB3345	REF		
R7, R8	Res, comp, 470, ±5%, 1/4W	170720	01121	CB2725	3		
R9	Res, comp, 4.7k ±5%, 1/4W	148072	01121	CB4725	1		
R10	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	3		
R11	Res, comp, 10k ±5%, 1/4W	148106	01121	CB1035	REF		

Table 614-1. 1.25 GHz Prescaler PCB Assembly, Option –14 (cont)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R13	Res, comp, 27k ±5%, 1/4W	170720	01121	CB2725	REF		
R14	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	REF		
R15	Res, comp, 470 ±5%, 1/4W	147983	01121	CB4715	REF		
R16	Res, comp, 51 ±5%, 1/8W	266262	01121	BB5101	1		
R17	Res, comp, 2.7k ±5%, 1/4W	170720	01121	CB2725	REF		
R18	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	REF		
R19	Res, comp, 1.5M ± 5%, 1/4W	349001	01121	CB1555	1		
U1	IC, Hybrid Linear	428797	31091	CA1044			
U2	IC, selected, 11C05	418186	89536	418186	1	1	
U3	IC, TTL, D-type	404574	07263	F11C06DC	1	1	
U4	IC, op-amp, mini-dip, 8 pin	402750	12040	LM741CN	1		
XU1	Socket, miniature	403642	00779	50863-B	28		
XU2	Socket, IC, 1p, 14 pin	291542	00779	582527-1	1		
XU3	Socket, IC, 1p, 16 pin	370312	00779	C931602	1		
1	Cable Assembly (not illustrated)	406942	89536	406942	1		
2	Connector, test jack	149112	74970	105-0753	2		
3	Deca, 10 MHz (not illustrated)	428037	89536	428037	1		
4	Receptical, amp	375329	00779	85863-3	1		

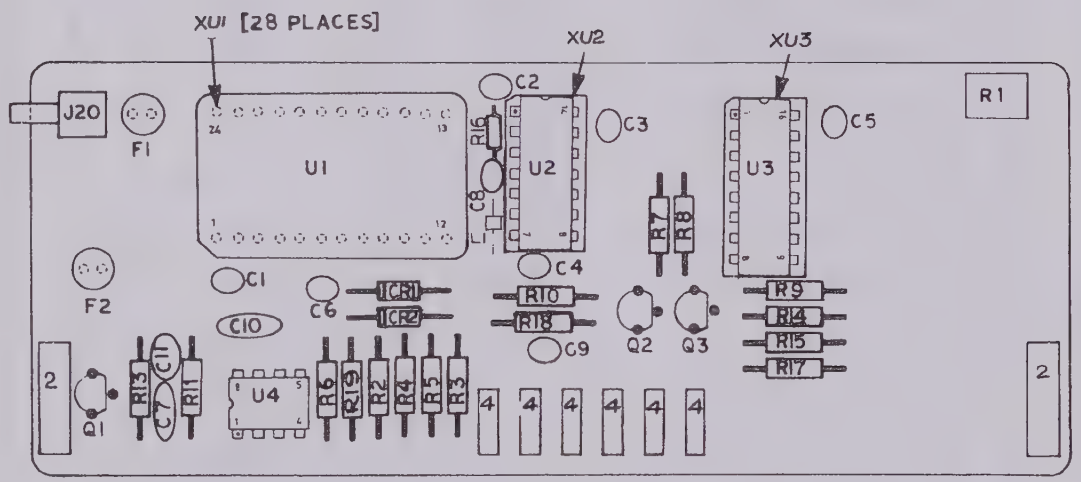

Figure 614-2. 1.25 GHz Prescaler PCB, Assembly

Section 7

General Information

7-1. This section of the manual contains generalized user information as well as supplemental information to the List of Replaceable parts contained in Section 5. The following information is presented in this section:

List of Abbreviations

Federal Supply Codes for Manufacturers

Fluke Technical Service Centers — U.S. and Canada

Sales and Service Locations — International

Sales Representatives — U.S. and Canada

Table 7-1. LIST OF ABBREVIATIONS AND SYMBOLS

A or amp	ampere
ac	alternating current
af	audio frequency
a/d	analog-to-digital
assy	assembly
AWG	american wire gauge
B	bel
bcd	binary coded decimal
^{o}C	Celsius
cap	capacitor
ccw	counterclockwise
cer	ceramic
cermet	ceramic to metal(seal)
ckt	circuit
cm	centimeter
cmrr	common mode rejection ratio
comp	composition
cont	continue
crt	cathode-ray tube
cw	clockwise
d/a	digital-to-analog
dac	digital-to-analog converter
dB	decibel
dc	direct current
dmm	digital multimeter
dvm	digital voltmeter
elect	electrolytic
ext	external
F	farad
^{o}F	Fahrenheit
FET	Field-effect transistor
ff	flip-flop
freq	frequency
FSN	federal stock number
g	gram
G	giga (10^{9})
gd	guard
Ge	germanium
GHz	gigahertz
gmv	guaranteed minimum value
gnd	ground
H	henry
hd	heavy duty
hf	high frequency
Hz	hertz
IC	integrated circuit
if	intermediate frequency
in	inch(es)
intl	internal
I/O	input/output
k	kilo (10^{3})
kHz	kilohertz
kΩ	kilohm(s)
kV	kilovolt(s)
lf	low frequency
LED	light-emitting diode
LSB	least significant bit
LSD	least significant digit
M	mega (10^{6})
m	milli (10^{-3})
mA	milliampere(s)
max	maximum
mf	metal film
MHz	megahertz
min	minimum
mm	millimeter
ms	millisecond
MSB	most significant bit
MSD	most significant digit
MTBF	mean time between failures
MTTR	mean time to repair
mV	millivolt(s)
mv	multivibrator
MΩ	megohm(s)
n	nano (10^{-9})
na	not applicable
NC	normally closed
(−) or neg	negative
NO	normally open
ns	nanosecond
opnl ampl	operational amplifier
p	pico (10^{-12})
para	paragraph
pcb	printed circuit board
pF	picofarad
pn	part number
(+) or pos	positive
pot	potentiometer
p-p	peak-to-peak
ppm	parts per million
PROM	programmable read-only memory
psi	pound-force per square inch
RAM	random-access memory
rf	radio frequency
rms	root mean square
ROM	read-only memory
s or sec	second (time)
scope	oscilloscope
SH	shield
Si	silicon
serno	serial number
sr	shift register
Ta	tantalum
tb	terminal board
tc	temperature coefficient or temperature compensating
tcxo	temperature compensated crystal oscillator
tp	test point
u or μ	micro (10^{-6})
uhf	ultra high frequency
us or μs	microsecond(s) (10^{-6})
uut	unit under test
V	volt
v	voltage
var	variable
vco	voltage controlled oscillator
vhf	very high frequency
vlf	very low frequency
W	watt(s)
ww	wire wound
xfmr	transformer
xstr	transistor
xtal	crystal
xtlo	crystal oscillator
Ω	ohm(s)
μ	micro (10^{-6})

Federal Supply Codes for Manufacturers (Continued)

00213
Nytronics Comp. Group Inc.
Subsidiary of Nytronics Inc.
Formerly Sage Electronics
Rochester, New York

00327
Welwyn International, Inc.
Westlake, Ohio

00656
Aerovox Corp.
New Bedford, Massachusetts

00686
Film Capacitors, Inc.
Passaic, New Jersey

00779
AMP Inc.
Harrisberg, Pennsylvania

01121
Allen-Bradley Co.
Milwaukee, Wisconsin

01281
TRW Electronic Comp.
Semiconductor Operations
Lawndale, California

01295
Texas Instruments, Inc.
Semiconductor Group
Dallas, Texas

01537
Motorola Communications &
Electronics Inc.
Franklin Park, Illinois

01686
RCL Electronics Inc.
Manchester, New Hampshire

01730
Replaced by 73586

01884 - use 56289
Sprague Electric Co.
Dearborn Electronic Div.
Lockwood, Florida

02114
Ferroxcube Corp.
Saugerties, New York

02131
General Instrument Corp.
Harris ASW Div.
Westwood, Maine

02395
Rason Mfg. Co.
Brooklyn, New York

02533
Snelgrove, C.R. Co., Ltd.
Don Mills, Ontario, Canada
M3B 1M2

02606
Fenwal Labs
Div. of Travenal Labs.
Morton Grove, Illinois

02660
Bunker Ramo Corp., Conn Div.
Formerly Amphenol-Borg
Electric Corp.
Broadview, Illinois

02799
Areo Capacitors, Inc.
Chatsworth, California

03508
General Electric Co.
Semiconductor Products
Syracuse, New York

03614
Replaced by 71400

03651
Replaced by 44655

03797
Eldema Div.
Genisco Technology Corp.
Compton, California

03877
Transistron Electronic Corp.
Wakefield, Massachusetts

03888
KDI Pyrofilm Corp.
Whippany, New Jersey

03911
Clairex Electronics Div.
Clairex Corp.
Mt. Vernon, New York

03980
Muirhead Inc.
Mountainside, New Jersey

04009
Arrow Hart Inc.
Hartford, Connecticut

04062
Replaced by 72136

04202
Replaced by 81312

04217
Essex International Inc.
Wire & Cable Div.
Anaheim, California

04221
Aemco, Div. of
Midtex Inc.
Mankato, Minnesota

04222
AVX Ceramics Div.
AVX Corp.
Myrtle Beach, Florida

04423
Telonic Industries
Laguna Beach, California

04645
Replaced by 75376

04713
Motorola Inc. Semiconductor
Products
Phoenix, Arizona

04946
Standard Wire & Cable
Los Angeles, California

05082
Replaced by 94988

05236
Jonathan Mfg. Co.
Fullerton, California

05245
Components Corp. now
Corcom, Inc.
Chicago, Illinois

05277
Westinghouse Electric Corp.
Semiconductor Div.
Youngwood, Pennsylvania

05278
Replaced by 43543

05279
Southwest Machine &
Plastic Co.
Glendora, California

05397
Union Carbide Corp.
Materials Systems Div.
New York, New York

05571 - use 56289
Sprague Electric Co.
Pacific Div.
Los Angeles, California

05574
Viking Industries
Chatsworth, California

05704
Replaced by 16258

05820
Wakefield Engineering Inc.
Wakefield, Massachusetts

06001
General Electric Co.
Electronic Capacitor &
Battery Products Dept.
Columbia, South Carolina

06136
Replaced by 63743

06383
Panduit Corp.
Tinley Park, Illinois

06473
Bunker Ramo Corp.
Amphenol SAMS Div.
Chatsworth, California

06555
Beede Electrical Instrument Co.
Penacook, New Hampshire

06739
Electron Corp.
Littleton, Colorado

06743
Clevite Corp.
Cleveland, Ohio

06751
Components, Inc. Semcor Div.
Phoenix, Arizona

06860
Gould Automotive Div.
City of Industry, California

06961
Vernitron Corp., Piezo
Electric Div.
Formerly Clevite Corp., Piezo
Electric Div.
Bedford, Ohio

06980
Eimac Div.
Varian Associates
San Carlos, California

07047
Ross Milton, Co., The
South Hampton, Pennsylvania

07115
Replaced by 14674

07138
Westinghouse Electric Corp.,
Electronic Tube Division
Horsehead, New York

07233
TRW Electronic Components
Cinch Graphic
City of Industry, California

07256
Silicon Transistor Corp.
Div. of BBF Group Inc.
Chelmsford, MA

07261
Aumet Corp.
Culver City, California

07263
Fairchild Semiconductor
Div. of Fairchild Camera
& Instrument Corp.
Mountain View, California

07344
Bircher Co., Inc.
Rochester, New York

07597
Burndy Corp.
Tape/Cable Div.
Rochester, New York

07792
Lerma Engineering Corp
Northampton, Massachusetts

07910
Teledyne Semiconductor
Formerly Continental Device
Hawthorne, California

07933 - use 49956
Raytheon Co.
Semiconductor Div. HQ
Mountain View, California

08225
Industro Transistor Corp.
Long Island City, New York

08261
Spectra Strip Corp.
Garden Grove, California

08530
Reliance Mica Corp.
Brooklyn, New York

08806
General Electric Co.
Miniature Lamp Products Dept.
Cleveland, Ohio

08863
Nylomatic Corp.
Norrisville, Pennsylvania

08988 - use 53085
Skottie Electronics Inc.
Archbald, Pennsylvania

09214
G.E. Co. Semi-Conductor
Products Dept.
Power Semi-Conductor
Products OPN Sec.
Auburn, New York

09353
C and K Components
Watertown, Massachusetts

09423
Scientific Components, Inc.
Santa Barbara, California

09922
Burndy Corp.
Norwalk, Connecticut

09969
Dale Electronics Inc.
Yankton, S. Dakota

10059
Barker Engineering Corp.
Formerly Amerace, Amerace
ESNA Corp.
Kenilworth, New Jersey

11236
CTS of Berne
Berne, Indiana

11237
CTS Keene Inc.
Paso Robles, California

11358
CBS Electronic Div.
Columbia Broadcasting System
Newburyport, MN

11403
Best Products Co.
Chicago, Illinois

11503
Keystone Columbia Inc.
Warren, Michigan

11532
Teledyne Relays
Hawthorne, California

11711
General Instrument Corp
Rectifier Division
Hickville, New York

11726
Qualidyne Corp.
Santa Clara, California

12014
Chicago Rivet & Machine Co.
Bellwood, Illinois

12040
National Semiconductor Corp.
Danburry, Connecticut

12060
Diodes, Inc.
Chatsworth, California

12136
Philadelphia Handle Co.
Camden, New Jersey

12300
Potter-Brumfield Division
AMF Canada LTD.
Guelph, Onatrio, Canada

12323
Presin Co., Inc.
Shelton, Connecticut

12327
Freeway Corp. formerly
Freeway Washer & Stamping Co.
Cleveland, Ohio

12443
Budd Co. The, Polychem Products
Plastic Products Div.
Bridgeport, PA

12615
U.S. Terminals Inc.
Cincinnati, Ohio

12617
Hamlin Inc.
Lake Mills, Wisconsin

12697
Clarostat Mfg. Co.
Dover, New Hampshire

12749
James Electronics
Chicago, Illinois

12856
Micrometals
Sierra Madre, California

12954
Dickson Electronics Corp.
Scottsdale, Arizona

12969
Unitrode Corp.
Watertown, Massachusetts

13103
Thermalloy Co., Inc.
Dallas, Texas

13327
Solitron Devices Inc.
Tappan, New York

13511
Amphenol Cadre Div.
Bunker-Ramo Corp.
Los Gatos, California

13606 - use 56289
Sprague Electric Co.
Transistor Div.
Concord, New Hampshire

13839
Replaced by 23732

14099
Semtech Corp.
Newbury Park, California

14140
Edison Electronic Div.
Mc Gray-Edison Co.
Manchester, New Hampshire

14193
Cal-R-Inc. formerly
California Resistor, Corp.
Santa Monica, California

14298
American Components, Inc.
an Insilco Co.
Conshohocken, Pennsylvania

14655
Cornell-Dublier Electronics
Division of Federal Pacific
Electric Co. Govt. Control Dept.
Newark, New Jersey

14752
Electro Cube Inc.
San Gabriel, California

14869
Replaced by 96853

14936
General Instrument Corp.
Semi Conductor Products Group
Hicksville, New York

15636
Elec-Trol Inc.
Saugus, California

15801
Fenwal Electronics Inc.
Div. of Kidde Walter and Co., Inc.
Framingham, Massachusetts

15818
Teledyne Semiconductors, formerly
Amelco Semiconductor
Mountain View, California

15849
Litton Systems Inc. Useco Div.
formerly Useco Inc.
Van Nuys, California

15898
International Business
Machines Corp.
Essex Junction, Vermont

15909
Replaced by 14140

16258
Space-Lok Inc.
Burbank, California

16299
Corning Glass
Electronic Components Div.
Raleigh, North Carolina

16332
Replaced by 28478

16473
Cambridge Scientific Ind.
Div. of Chemed Corporation
Cambridge, Maryland

16742
Paramount Plastics Fabricators, Inc.
Downey, California

16758
Delco Electronics
Div. of General Motors Corp.
Kokomo, Indiana

17001
Replaced by 71468

17069
Circuit Structures Lab.
Burbank, California

17338
High Pressure Eng. Co., Inc.
Oklahoma City, Oklahoma

17545
Atlantic Semiconductors, Inc.
Asbury Park, New Jersey

17856
Siliconix, Inc.
Santa Clara, California

17870
Replaced by 14140

18178
Vactec Inc.
Maryland Heights, Missouri

18324
Signetics Corp.
Sunnyvale, California

18612
Vishay Resistor Products Div.
Vishay Intertechnology Inc.
Malvern, Pennsylvania

18736
Voltronics Corp.
Hanover, New Jersey

18927
G T E Sylvania Inc.
Precision Material Group
Parts Division
Titusville, Pennsylvania

19451
Perine Machinery & Supply Co.
Seattle, Washington

19701
Electro-Midland Corp.
Mepco-Electra Inc.
Mineral Wells, Texas

20584
Enochs Mfg. Inc.
Indianapolis, Indiana

20891
Self-Organizing Systems, Inc.
Dallas, Texas

21604
Buckeye Stamping Co.
Columbus, Ohio

21845
Solitron Devices Inc.
Transistor Division
Riveria Beach, Florida

22767
ITT Semiconductors
Palo Alto, California

23050
Product Comp. Corp.
Mount Vernon, New York

23732
Tracor Inc.
Rockville, Maryland

23880
Stanford Applied Engrng.
Santa Clara, California

23936
Pamotor Div., Wm. J. Purdy Co.
Burlingame, California

24248
Replaced by 94222

24355
Analog Devices Inc.
Norwood, Massachusetts

24655
General Radio
Concord, Massachusetts

24759
Lenox-Fugle Electronics Inc.
South Plainfield, New Jersey

25088
Siemen Corp.
Isilen, New Jersey

25403
Amperex Electronic Corp.
Semiconductor &
Micro-Circuits Div.
Slatersville, Rhode Island

27014
National Semiconductor Corp.
Santa Clara, California

27264
Molex Products
Downers Grove, Illinois

28213
Minnesota Mining & Mfg. Co.
Consumer Products Div.
St. Paul, Minnesota

28425
Serv-/-Link formerly
Bohannan Industries
Fort Worth, Texas

28478
Deltrol Controls Div.
Deltrol Corporation
Milwaukee, Wisconsin

28480
Hewlett Packard Co. Corporate H.Q.
Palo Alto, California

28520
Heyman Mfg. Co.
Kenilworth, New Jersey

29083
Monsanto, Co., Inc.
Santa Clara, California

29604
Stackpole Components Co.
Raleigh, North Carolina

30148
A B Enterprise Inc.
Ahoskie, North Carolina

30323
Illinois Tool Works, Inc.
Chicago, Illinois

31091
Optimax Inc.
Colmar, Pennsylvania

32539
Mura Corp.
Great Neck, New York

32767
Griffith Plastic Corp.
Burlingame, California

32879
Advanced Mechanical Components
Northridge, California

32897
Erie Technological Products, Inc.
Frequency Control Div.
Carlisle, Pennsylvania

32997
Bourns Inc.
Trimpot Products Division
Riverside, California

33173
General Electric Co.
Products Dept.
Owensboro, Kentucky

Federal Supply Codes for Manufacturers (Continued)

34333
Silicon General
Westminister, California

34335
Advanced Micro Devices
Sunnyvale, California

34802
Electromotive Inc.
Kenilworth, New Jersey

37942
Mallory, P.R. & Co., Inc.
Indianapolis, Indiana

42498
National Radio
Melrose, Massachusetts

43543
Nytronics Inc.
Transformer Co. Div.
Geneva, New York

44655
Ohmite Mfg. Co.
Skokie, Illinois

49671
RCA Corp.
New York, New York

49956
Raytheon Company
Lexington, Massachusetts

50088
Mostek Corp.
Carrollton, Texas

50579
Litronix Inc.
Cupertino, California

51605
Scientific Components Inc.
Linden, New Jersey

53021
Sangamo Electric Co.
Springfield, Illinois

54294
Cutler-Hammer Inc. formerly
Shallcross, A Cutter-Hammer Co.
Selma, North Carolina

55026
Simpson Electric Co.
Div. of Am. Gage and Mach. Co.
Elgin, Illinois

56289
Sprague Electric Co.
North Adams, Massachusetts

58474
Superior Electric Co.
Bristol, Connecticut

60399
Torin Corp, formerly
Torrington Mfg. Co.
Torrington, Connecticut

63743
Ward Leonard Electric Co., Inc.
Mount Vernon, New York

64834
West Mfg. Co.
San Francisco, Californai

65092
Weston Instruments Inc.
Newark, New Jersey

66150
Winslow Tele-Tronics Inc.
Eaton Town, New Jersey

70485
Atlantic India Rubber Works
Chicago, Illinois

70563
Amperite Company
Union City, New Jersey

70903
Belden Corp.
Geneva, Illinois

71002
Birnbach Radio Co., Inc.
Freeport, LI New York

71400
Bussmann Mfg.
Div. of McGraw-Edison Co.
Saint Louis, Missouri

71450
CTS Corp.
Elkhart, Indiana

71468
ITT Cannon Electric Inc.
Santa Ana, California

71482
Clare, C.P. & Co.
Chicago, Illinois

71590
Centrelab Electronics
Div. of Globe Union Inc.
Milwaukee, Wisconsin

71707
Coto Coil Co., Inc.
Providence, Rhode Island

71744
Chicago Miniature Lamp Works
Chicago, Illinois

71785
TRW Electronics Components
Cinch Connector Operations Div.
Elk Grove Village, Chicago, Illinois

72005
Driver, Wilber B., Co.
Newark, New Jersey

72092
Replaced by 06980

72136
Electro Motive Mfg. Co.
Williamantic, Connecticut

72259
Nytronics Inc.
Pelham Manor, New Jersey

72619
Dialight Div.
Amperex Electronic Corp.
Brooklyn, New York

72653
G.C. Electronics
Div. of Hydrometals, Inc.
Brooklyn, New York

72665
Replaced by 90303

72794
Dzus Fastener Co., Inc.
West Islip, New York

72928
Gulton Ind. Inc.
Gudeman Div.
Chicago, Illinois

72982
Erie Tech. Products Inc.
Erie, Pennsylvania

73138
Beckman Instruments Inc.
Helipot Division
Fullerton, California

73293
Hughes Aircraft Co.
Electron Dynamics Div.
Torrence, California

73445
Amperex Electronic Corp.
Hicksville, LI, New York

73559
Carling Electric Inc.
West Hartford, Connecticut

73586
Circle F Industries
Trenton, New Jersey

73734
Federal Screw Products, Inc.
Chicago, Illinois

73743
Fischer Special Mfg. Co.
Cincinnati, Ohio

73899
JFD Electronics Co.
Components Corp
Brooklyn, New York

73949
Guardian Electric Mfg. Co.
Chicago, Illinois

74199
Quan Nichols Co.
Chicago, Illinois

74217
Radio Switch Corp.
Marlboro, New Jersey

74276
Signalite Div.
General Instrument Corp.
Neptune, New Jersey

74306
Piezo Crystal Co.
Carlisle, Pennsylvania

74542
Hoyt Elect. Instr. Works
Penacook, New Hampshire

74970
Johnson E.F., Co.
Waseca, Minnesota

75042
TRW Electronics Components
IRC Fixed Resistors
Philadelphia, Pennsylvania

75376
Kurz-Kasch Inc.
Dayton, Ohio

75378
CTS Knights Inc.
Sandwich, Illinois

75382
Kulka Electric Corp.
Mount Vernon, New York

75915
Littlefuse Inc.
Des Plaines, Illinois

76854
Oak Industries Inc.
Switch Div.
Crystal Lake, Illinois

77342
AMF Inc.
Potter & Brumfield Div.
Princeton, Indiana

77638
General Instrument Corp.
Rectifier Division
Brooklyn, New York

77969
Rubbercraft Corp. of CA. LTD.
Torrance, California

78189
Shakeproof
Div. of Illinois Tool Works Inc.
Elgin, Illinois

78277
Sigma Instruments, Inc.
South Braintree, Massachusetts

78488
Stackpole Carbon Co.
Saint Marys, Pennsylvania

78553
Eaton Corp. Engineered
Fastener Div.
Tinnerman Plant
Cleveland, Ohio

79136
Waldes Kohinoor Inc
Long Island City, New York

79497
Western Rubber Company
Goshen, Indiana

79963
Zierick Mfg. Corp.
Mt. Kisko, New York

80031
Electro-Midland Corp., Mepco Div.
A North American Phillips Co.
Morristown, New Jersey

80145
LFE Corp., Process Control Div.
formerly API Instrument Co.
Chesterland, Ohio

80183 - use 56289
Sprague Products
North Adams, Massachusetts

80294
Bourns Inc., Instrument Div.
Riverside, California

80583
Hammarlund Mfg. Co., Inc.
Red Bank, New Jersey

80640
Stevens, Arnold Inc.
South Boston, Massachusetts

81073
Grayhill, Inc.
La Grange, Illinois

81312
Winchester Electronics
Div. of Litton Industries Inc.
Oakville, Connecticut

81439
Therm-O-Disc Inc.
Mansfield, Ohio

81483
International Rectifier Corp.
Los Angeles, California

81590
Korry Mfg. Co.
Seattle, Washington

81741
Chicago Lock Co.
Chicago, Illinois

82305
Palmer Electronics Corp.
South Gate, California

82389
Switchcraft Inc.
Chicago, Illinois

82415
North American Phillips
Controls Corp.
Frederick, Maryland

82872
Roanwell Corp.
New York, New York

82877
Rotron Inc.
Woodstock, New York

82879
ITT Royal Electric Div.
Pawtucket, Rhode Island

83003
Varo Inc.
Garland, Texas

83058
Carr Co., The United Can Div.
of TRW
Cambridge, Messachusetts

83298
Bendix Corp.
Electric Power Division
Eatontown, New Jersey

83330
Smith, Herman H., Inc.
Brooklyn, New York

83478
Rubbercraft Corp. of America, Inc.
West Haven, Connecticut

83594
Burroughs Corp.
Electronic Components Div.
Plainfield, New Jersey

83740
Union Carbide Corp.
Battery Products Div.
formerly Consumer Products Div.
New York, New York

84171
Arco Electronics
Great Neck, New York

84411
TRW Electronic Components
TRW Capacitors
Ogallala, Nebraska

84613
Fuse Indicator Corp.
Rockville, Maryland

84682
Essex International Inc.
Industrial Wire Div.
Peabody, Massachusetts

86577
Precision Metal Products,
of Malden Inc.
Stoneham, Massachusetts

86684
Radio Corp. of America
Electrbnic Components Div.
Harrison, New Jersey

86928
Seastrom Mfg. Co., Inc.
Glendale, California

87034
Illuminated Products Inc.
Subsidiary of Oak Industries Inc.
Anahiem, California

88219
Gould Inc.
Industrial Div.
Trenton, New Jersey

88245
Litton Systems Inc.
Useco Div.
Van Nuys, California

88419
Cornell-Dubilier Electronic Div.
Federal Pacific Co.
Fuquay-Varian, North Carolina

88486
Plastic Wire & Cable
Jewitt City, Connecticut

88690
Replaced by 04217

89536
Fluke, John Mfg. Co., Inc.
Seattle, Washington

89730
G.E. Co., Newark Lamp Works
Newark, New Jersey

90201
Mallory Capacitor Co. Div of
P.R. Mallory Co., Inc.
Indianapolis, Indiana

90211 - use 56365
Square D Co.
Chicago, Illinois

90215
Best Stamp & Mfg. Co.
Kansas City, Missouri

90303
Mallory Battery Co.
Div. of Mallory Co., Inc.
Tarrytown, New York

91094
Essex International Inc.
Suglex/IWP Div.
Newmarket, New Hampshire

91293
Johanson Mfg. Co.
Boonton, New Jersey

91407
Replaced by 58474

91502
Associated Machine
Santa Clara, California

91506
Augat Inc.
Attlaboro, Massachusetts

91637
Dale Electronics Inc.
Columbus, Nebraska

91662
Elco Corp.
Willow Grove, Pennsylvania

91737 - use 71468
Gremar Mfg. Co., Inc.
ITT Cannon/Gremar
Santa Ana, California

91802
Industrial Devices, Inc.
Edgewater, New Jersey

91833
Keystone Electronics Corp.
New York, New York

91836
King's Electronics Co., Inc.
Tuckahoe, New York

91929
Honeywell Inc.
Micro Switch Div.
Freeport, Illinois

91934
Miller Electric Co., Inc.
Div of Aunet
Woonsocket, Rhode Island

92194
Alpha Wire Corp.
Elizabeth, New Jersey

93332
Sylvania Electric Products
Semiconductor Products Div.
Woburn, Massachusetts

94145
Replaced by 49956

94154 - use 94988
Wagner Electric Corp.
Tung-Sol Div.
Newark, New Jersey

94222
Southco Inc. formerly
South Chester Corp.
Lester, Pennsylvania

95146
Alco Electronic Products Inc.
Lawrence, Massachusetts

95263
Leecraft Mfg. Co.
Long Island City, New York

95264
Replaced by 98278

95275
Vitramon Inc.
Bridgeport, Connecticut

95303
RCA Corp.
Receiving Tube Div.
Cincinnati, Ohio

95348
Gordo's Corp.
Bloomfield, New Jersey

95354
Methode Mfg. Corp.
Rolling Meadows, Illinois

95712
Bendix Corp.
Electrical Components Div.
Microwave Devices Plant
Franklin, Indiana

95987
Weckesser Co. Inc.
Chicago, Illinois

96733
San Fernando Electric Mfg. Co.
San Fernando, California

96853
Gulton Industries Inc.
Measurement and Controls Div.
formerly Rustrak Instruments Co.
Manchester, New Hampshire

96881
Thomson Industries, Inc.
Manhasset, New York

97540
Master Mobile Mounts
Div. of Whitehall Electronics Corp.
Ft. Meyers, Florida

97913
Industrial Electronic Hdware Corp.
New York, New York

97945
Penwalt Corp.
SS White Industrial Products Div.
Piscataway, New Jersey

97966
Replaced by 11358

98094
Replaced by 49956

98159
Rubber-Teck, Inc.
Gardena, California

98278
Malco A Microdot Co., Inc.
Connector & Cable Div.
Pasadena, California

98291
Sealectro Corp.
Mamaroneck, New York

98388
Royal Industries
Products Div.
San Diego, California

98743
Replaced by 12749

98925
Replaced by 14433

99120
Plastic Capacitors, Inc.
Chicago, Illinois

99217
Bell Industries Elect. Comp. Div.
formerly Southern Elect. Div.
Burbank, California

99392
STM
Oakland, California

99515
ITT Jennings Monrovia Plant
Div. of ITT Jennings formerly
Marshall Industries Capacitor Div.
Monrovia, California

99779 - use 29587
Bunker-Ramo Corp.
Barnes Div.
Landsdowne, Pennsylvania

99800
American Precision Industries Inc.
Delevan Division
East Aurora, New York

99942
Centrelab Semiconductor
Centrelab Electronics Div. of
Globe-Union Inc.
El Monte, California

Toyo Electronics
(R-Ohm Corp.)
Irvine, California

National Connector
Minneapolis, Minnesota

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Tel (416) 678-1500

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Section 8
Schematic Diagrams

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Table 8-1. Mnemonics

Ah = Ampere–Hours
BE = Burst Enable
BST = Burst
BTn = Battery
DP = Decimal Point
FD = Direct Preamplifier Frequency
FF = Frequency Flip Flop
FM = Multiplier Frequency
FT = Input Multiplier Frequency
G = Gate Time
LT = Lamp Test
M = Memory Update
nKn = n. nK
OVFL = Overflow
R = Reset
RES = Resolution Annunciation
UNLK = Unlock Phase (0) Loop

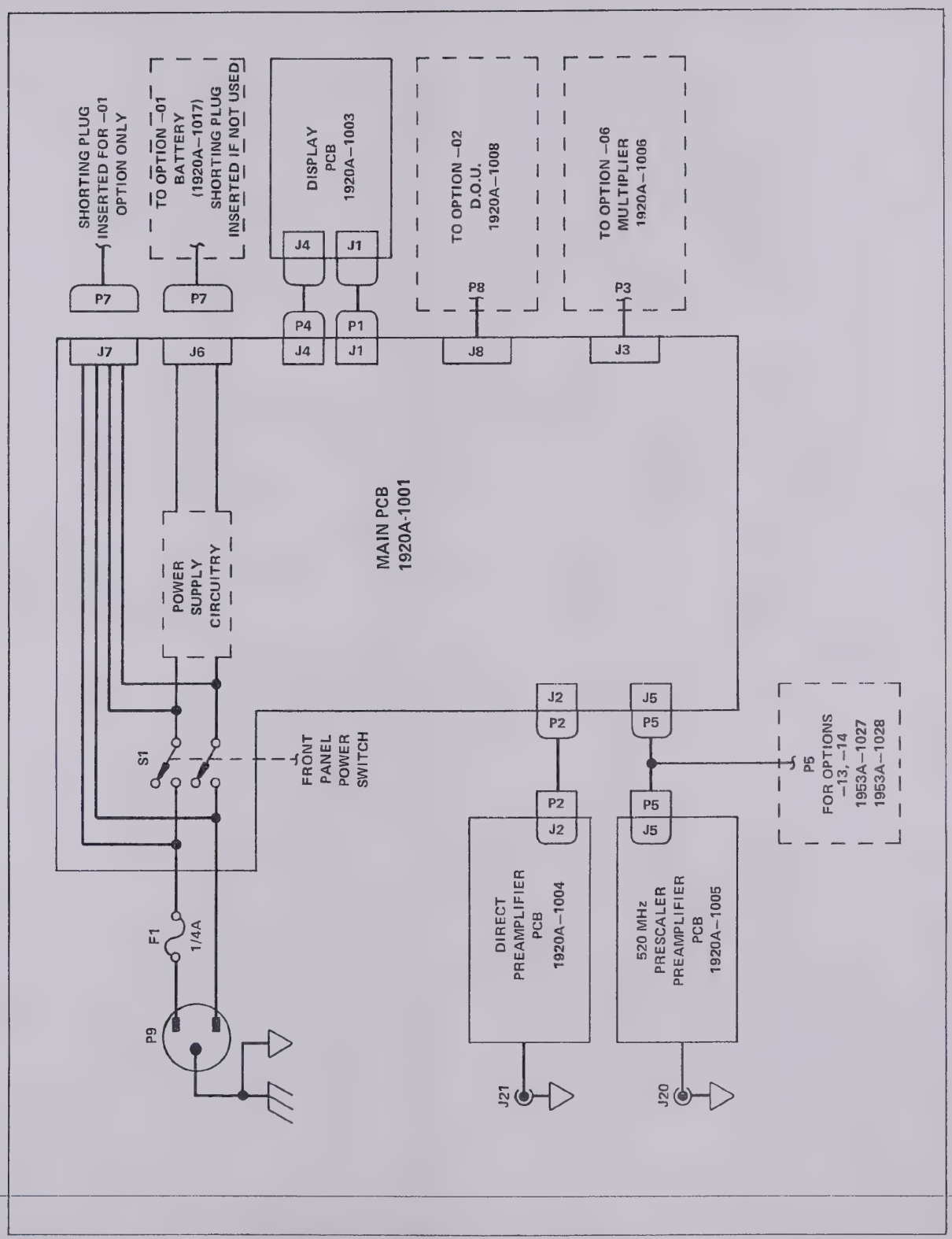


Figure 8-1. 1920A Interconnect, Block Diagram

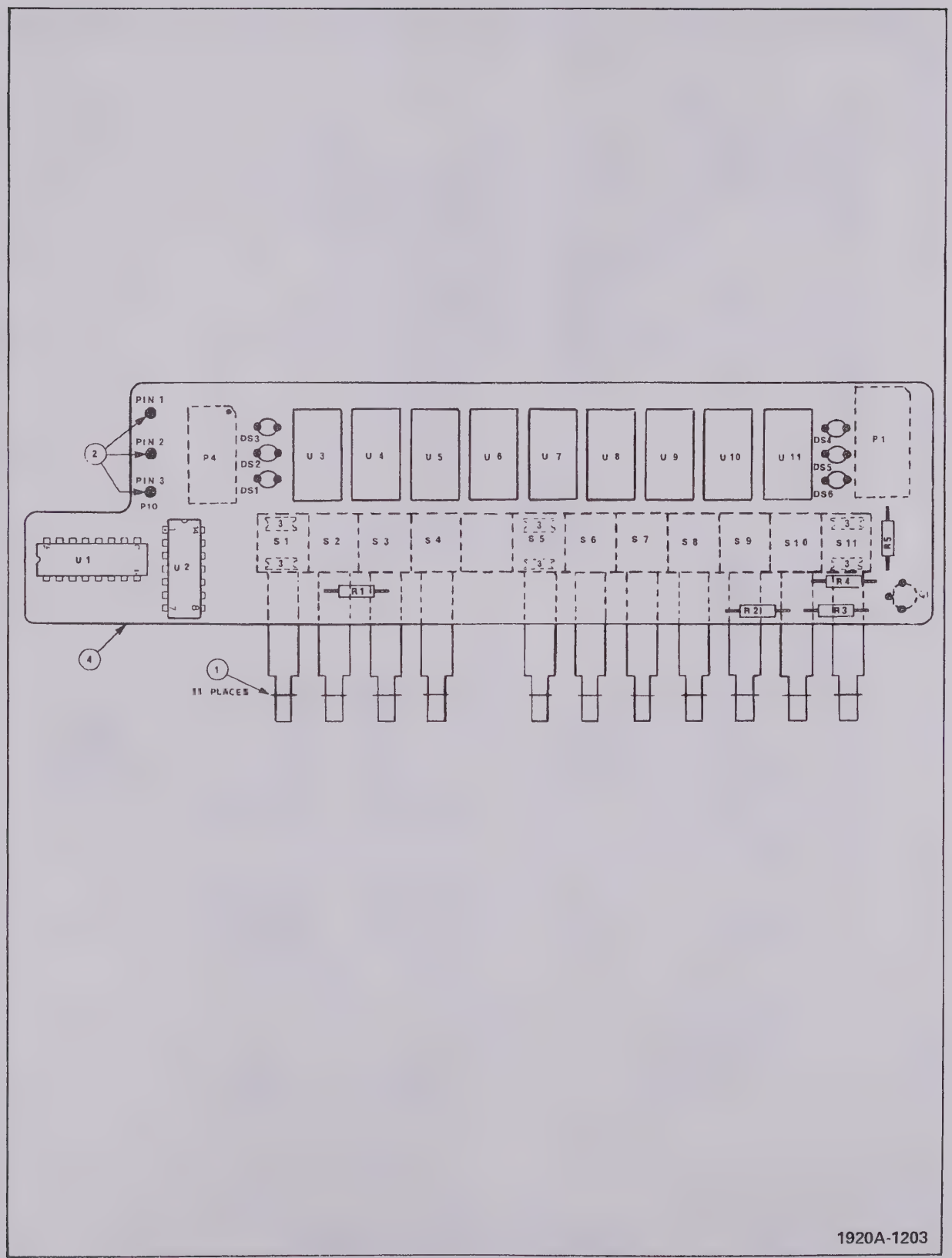
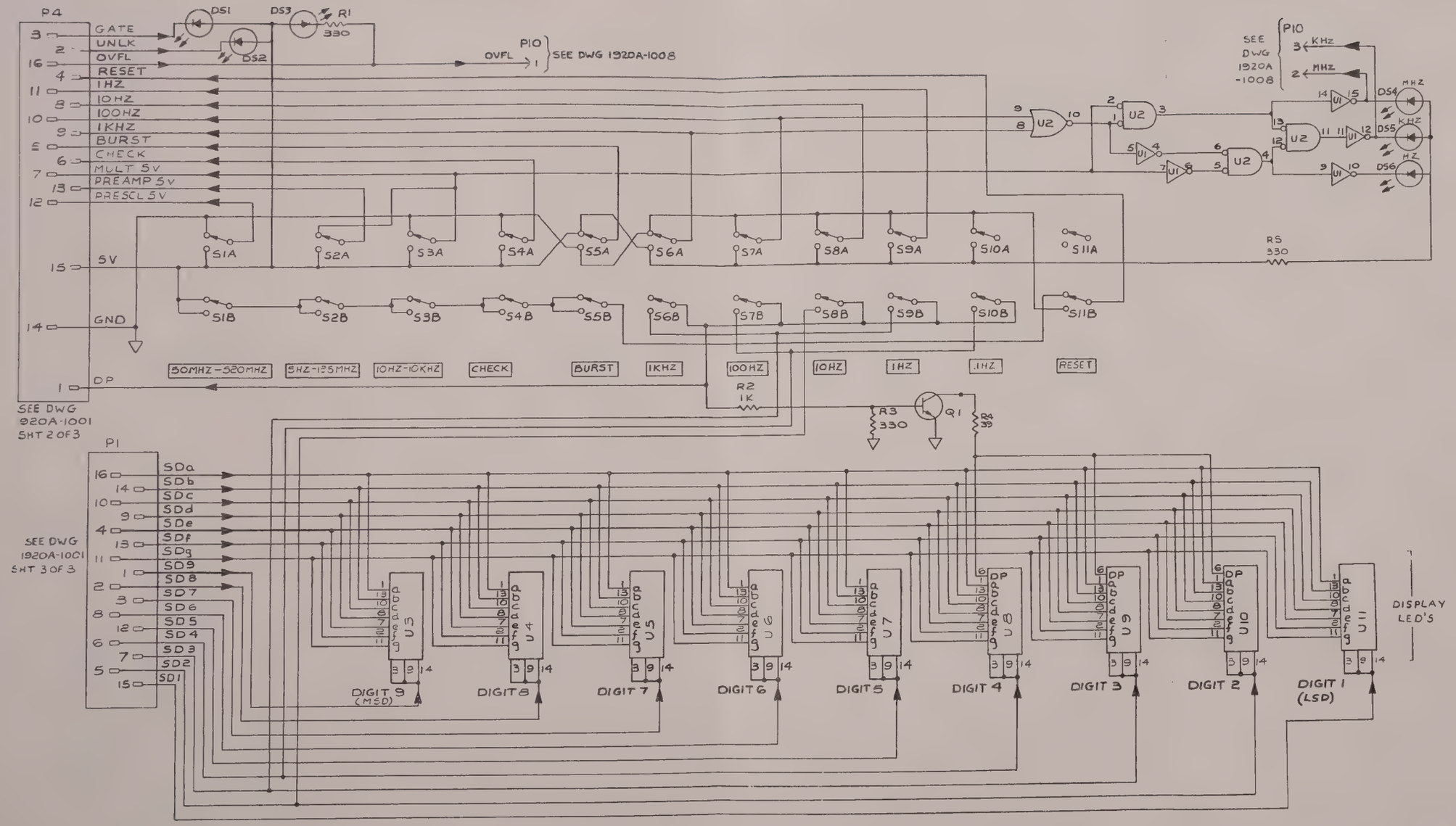


Figure 8-2. A1 Display PCB Assembly



NOTES:
1. ALL RESISTORS ARE IN OHMS, 1/4 W, 5% C.C UNLESS OTHERWISE NOTED.
2. ALL THE SWITCHES ARE IN RELEASED POSITIONS.

1920A-1003

Figure 8-2. A1 Display PCB Assembly (cont)

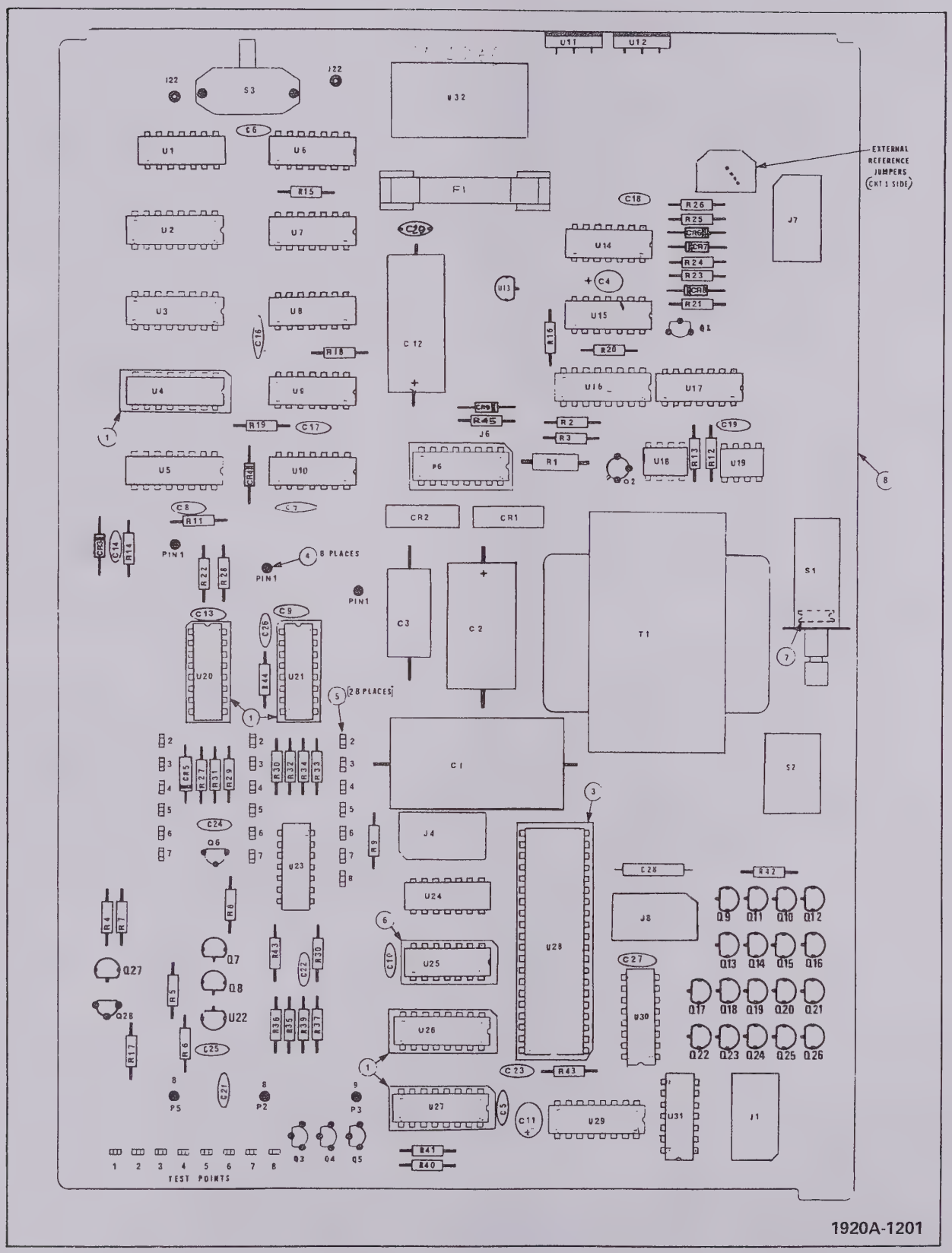
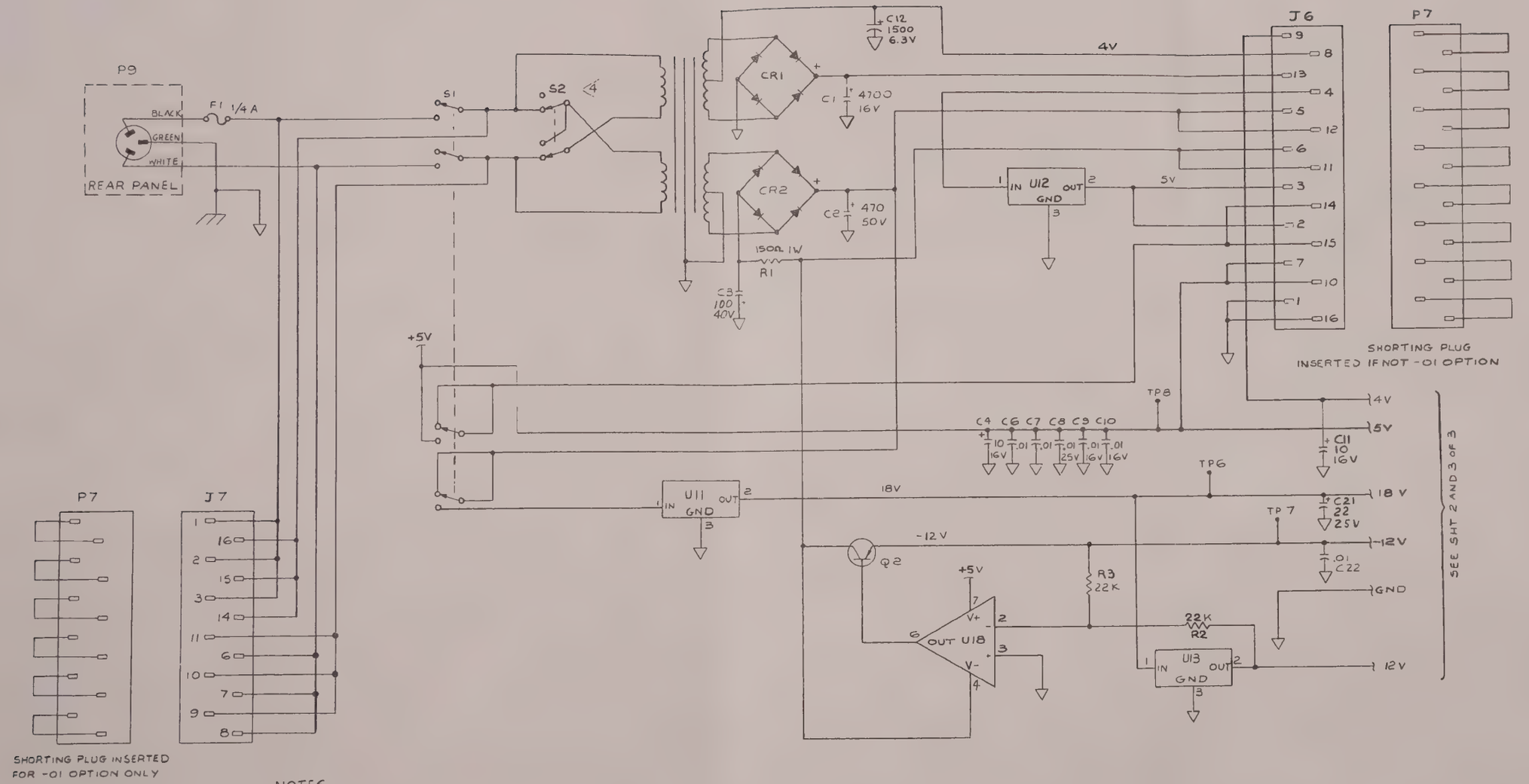


Figure 8-3. A2 Main PCB Assembly

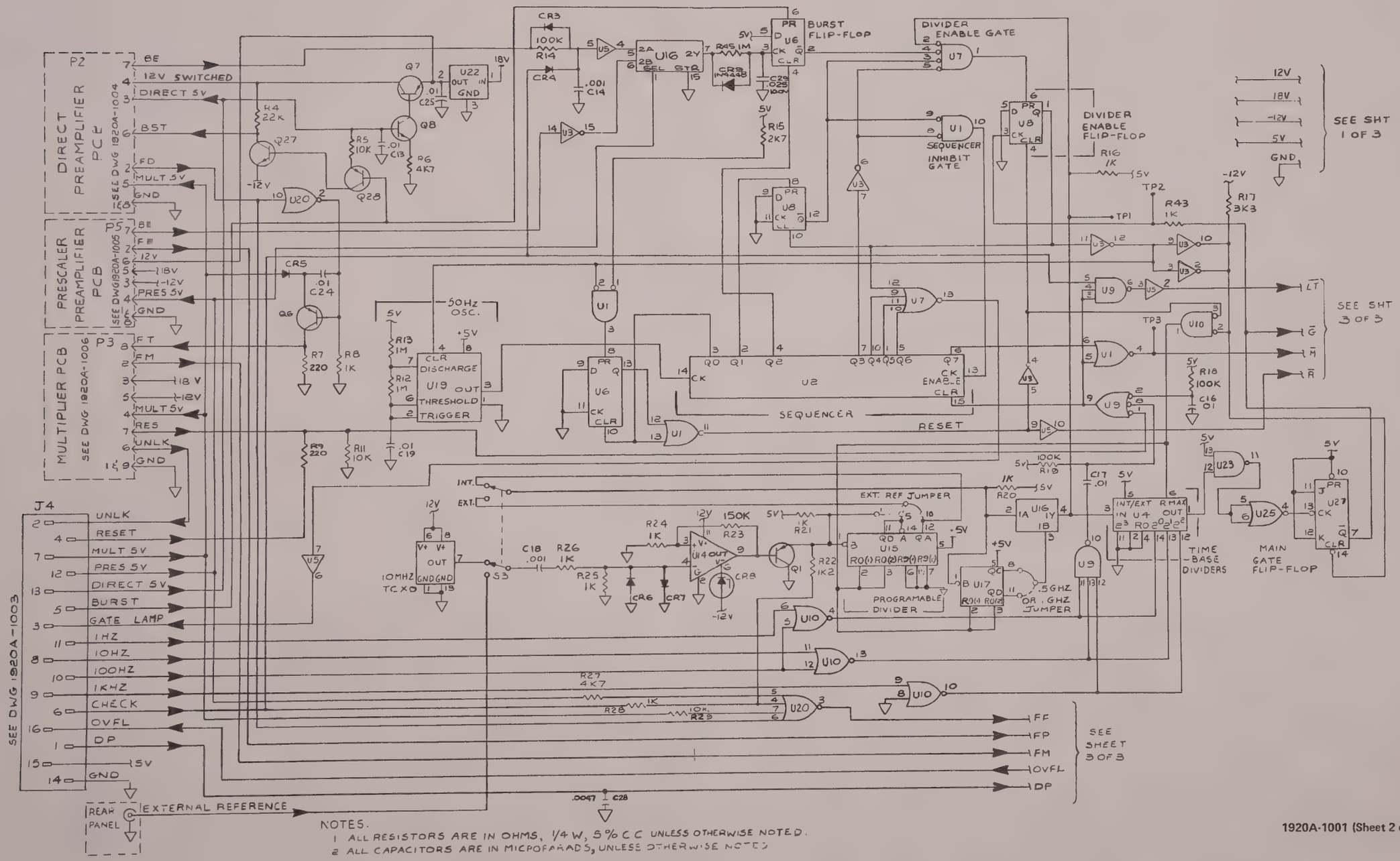


NOTES

1. ALL RESISTORS ARE IN OHMS 1/4 W, 5% C C. UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS ARE N MICROFARADS UNLESS OTHERWISE NOTED
3. POWER SWITCH S1 SHOWN IN OFF POSITION
4. 110V/220V SWITCH S2 SHOWN IN 110V POSITION

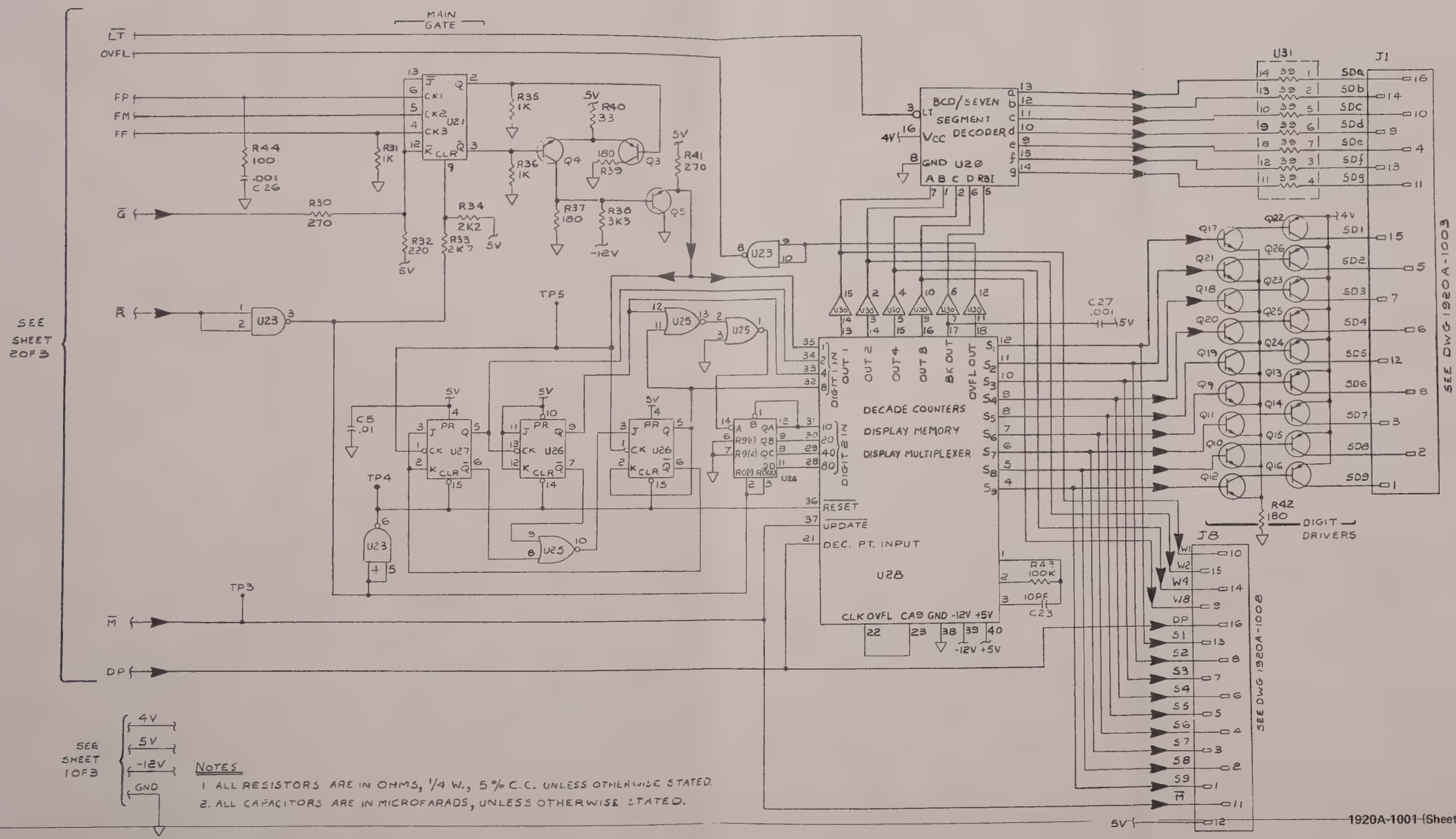
1920A-1001 (Sheet 1 of 3)

Figure 8-3. A2 Main PCB Assembly (cont)



1920A-1001 (Sheet 2 of 3)

Figure 8-3. A2 Main PCB Assembly (cont)



1920A-1001 (Sheet 3 of 3)

Figure 8-3. A2 Main PCB Assembly (cont)

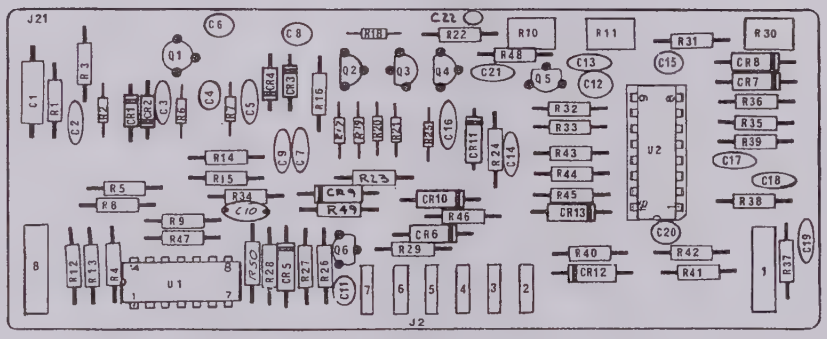
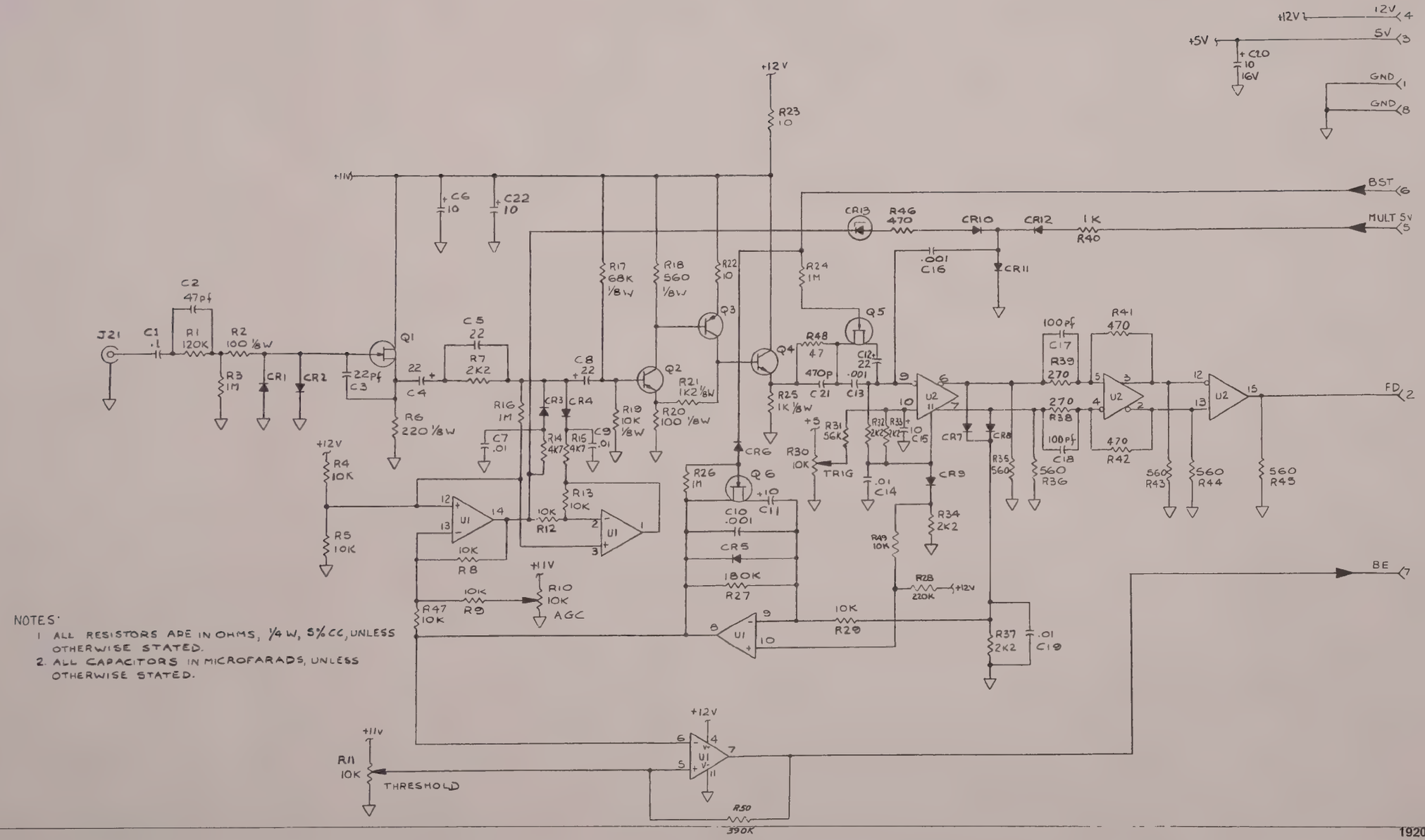


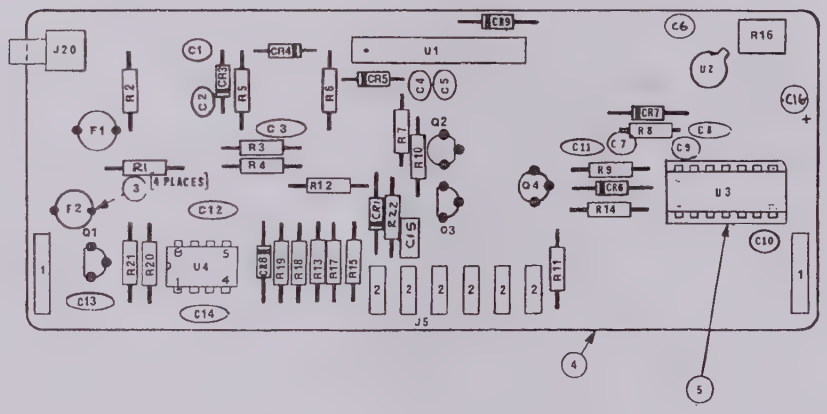
Figure 8-4. A3 Direct Preamplifier PCB Assembly



NOTES:
1. ALL RESISTORS ARE IN OHMS, 1/4 W, 5% CC, UNLESS OTHERWISE STATED.
2. ALL CAPACITORS IN MICROFARADS, UNLESS OTHERWISE STATED.

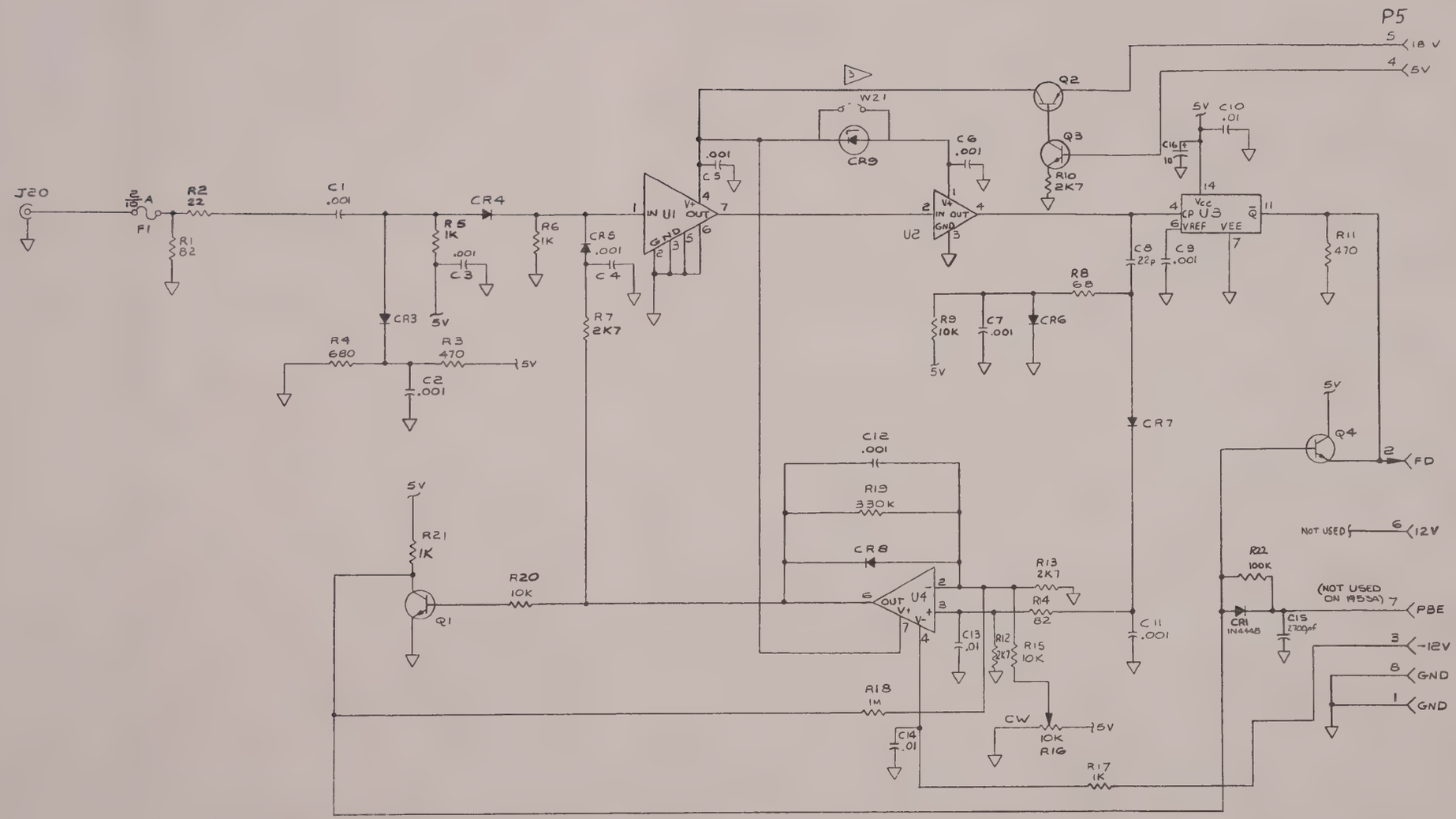
1920A-1004

Figure 8-4. A3 Direct Preamplifier PCB Assembly (cont)



1953A-1226

Figure 8-5. A4 520 MHz Prescaler PCB Assembly



NOTES

1. ALL RESISTORS ARE IN OHMS, 1/4 W, 5% CC UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS ARE IN MICROFARADS, UNLESS OTHERWISE NOTED
3. NORMAL U2 IS GPD 402, IF GPD 603 IS USED INSTALL JUMPER WIRE ACROSS W21

1953-1026

Figure 8-5. A4 520 MHz Prescaler PCB Assembly (cont)

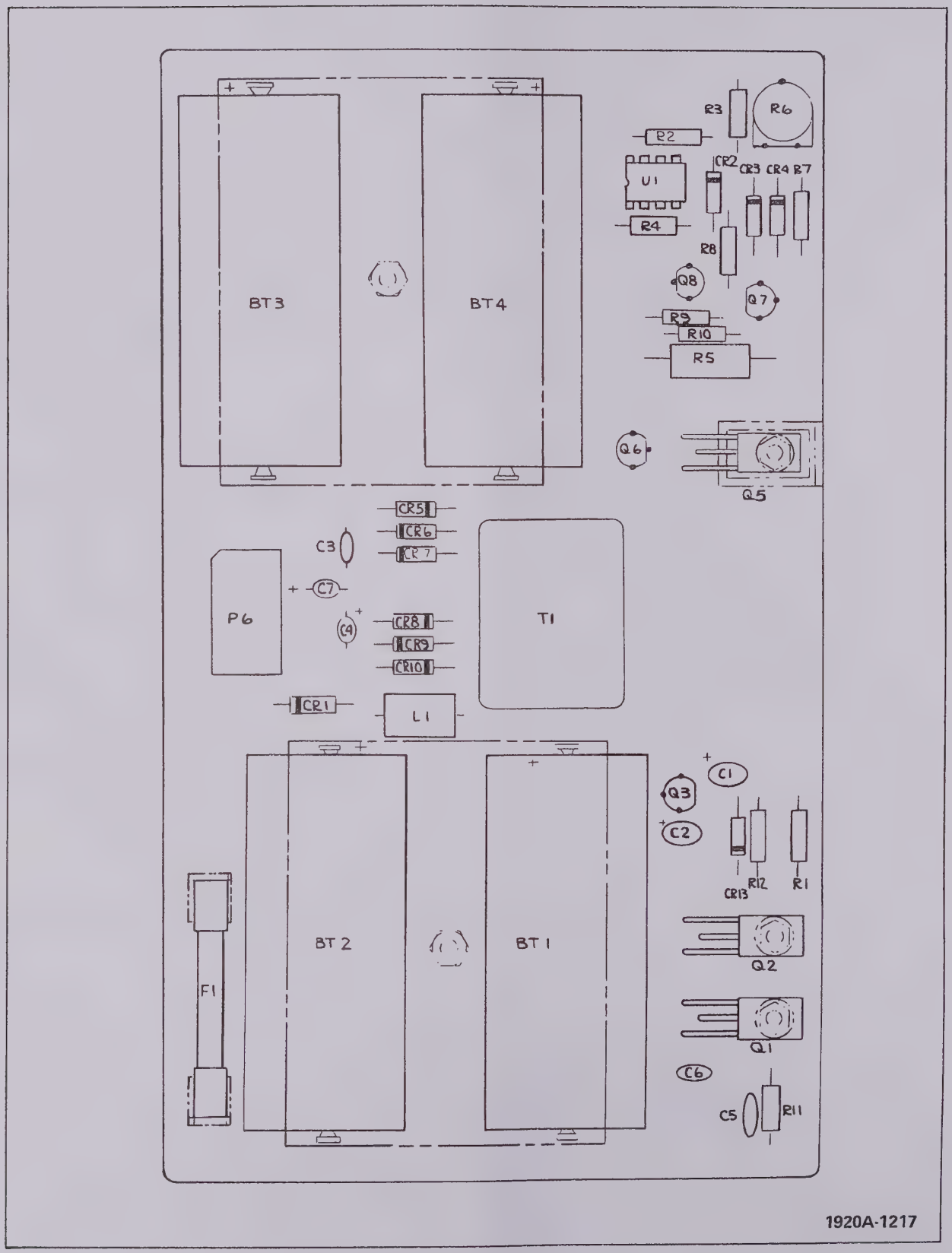
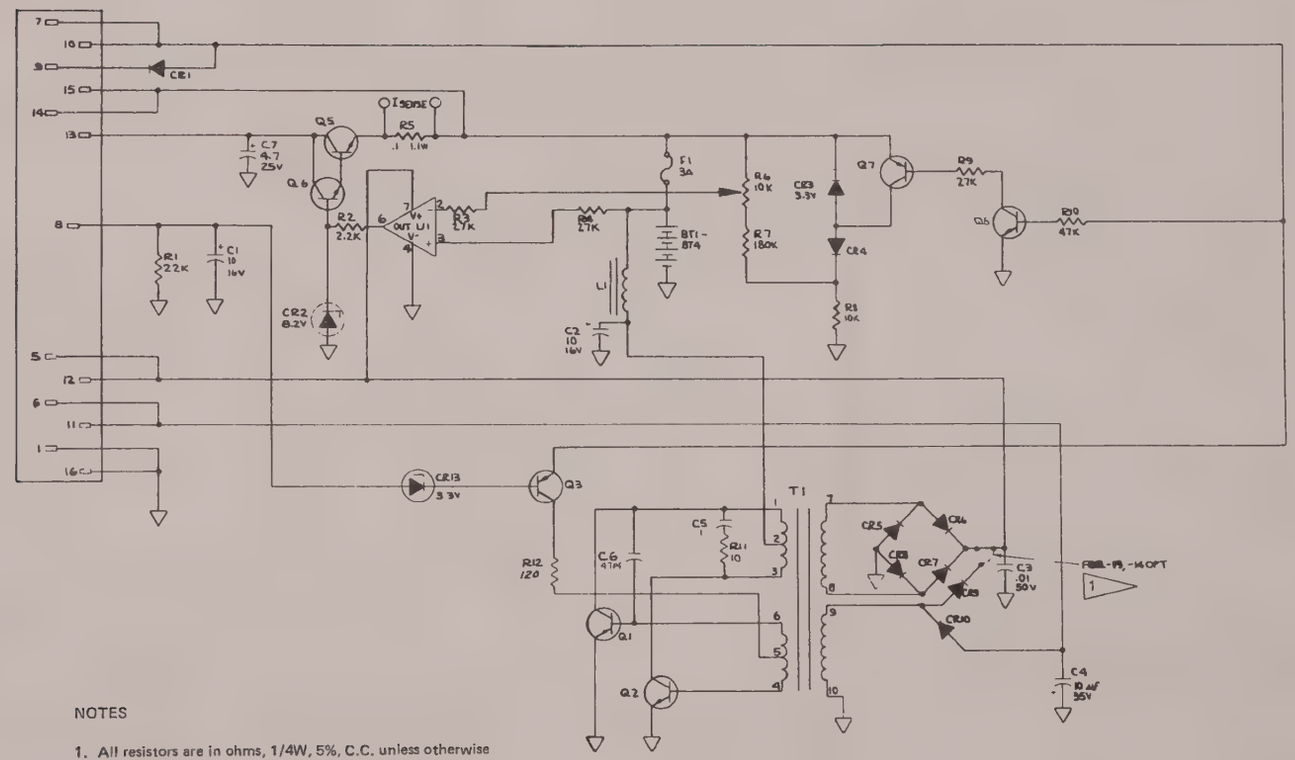


Figure 8-6. Rechargeable Battery PCB Assembly



NOTES

1. All resistors are in ohms, 1/4W, 5%, C.C. unless otherwise specified.
2. All capacitors are in microfarads, unless otherwise noted.

1 For use with –13 or –14 Prescaler Options.

Cut land as noted for –07 Option and add jumper as indicated.

1920A-1017

Figure 8-6. Rechargeable Battery PCB Assembly (cont)

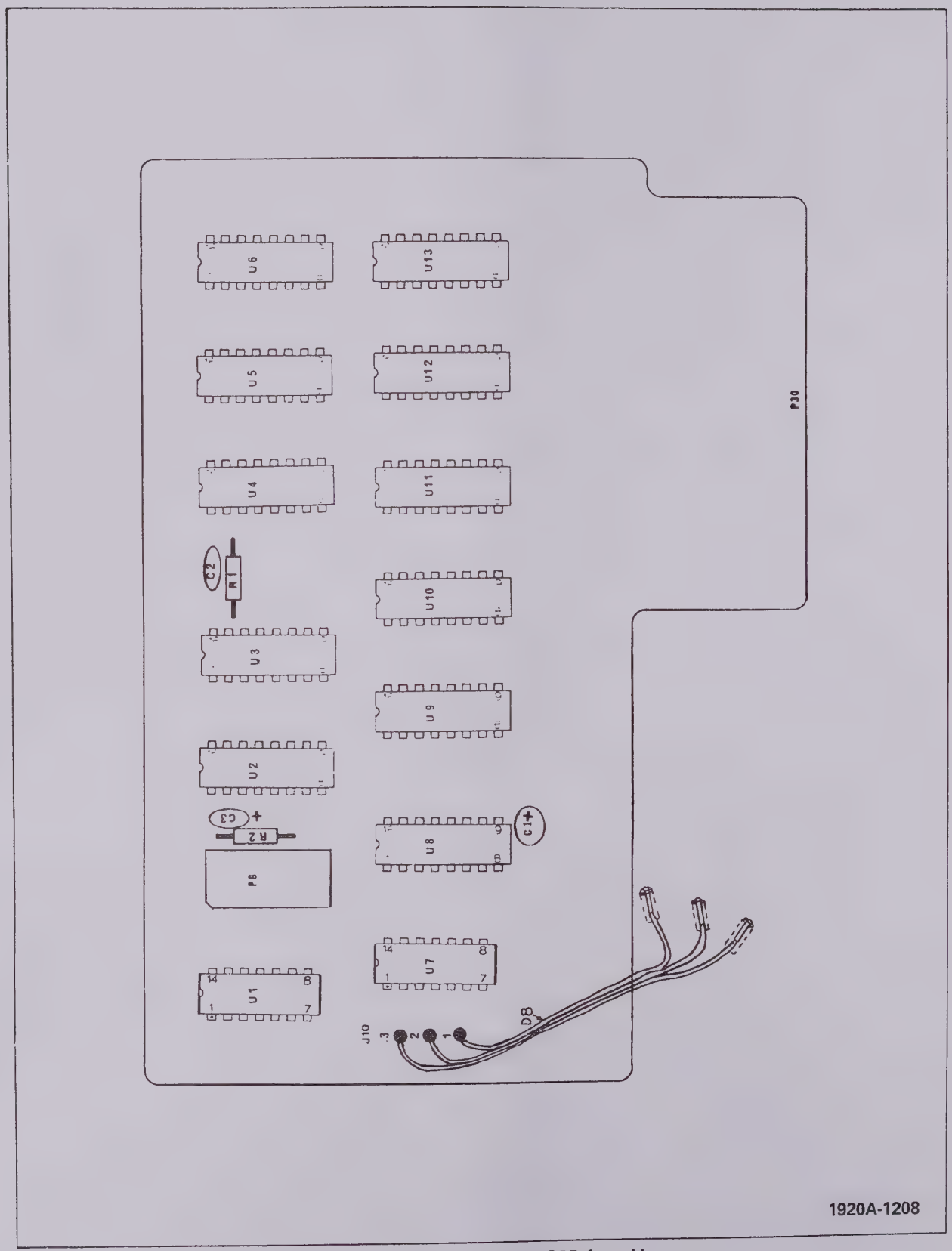
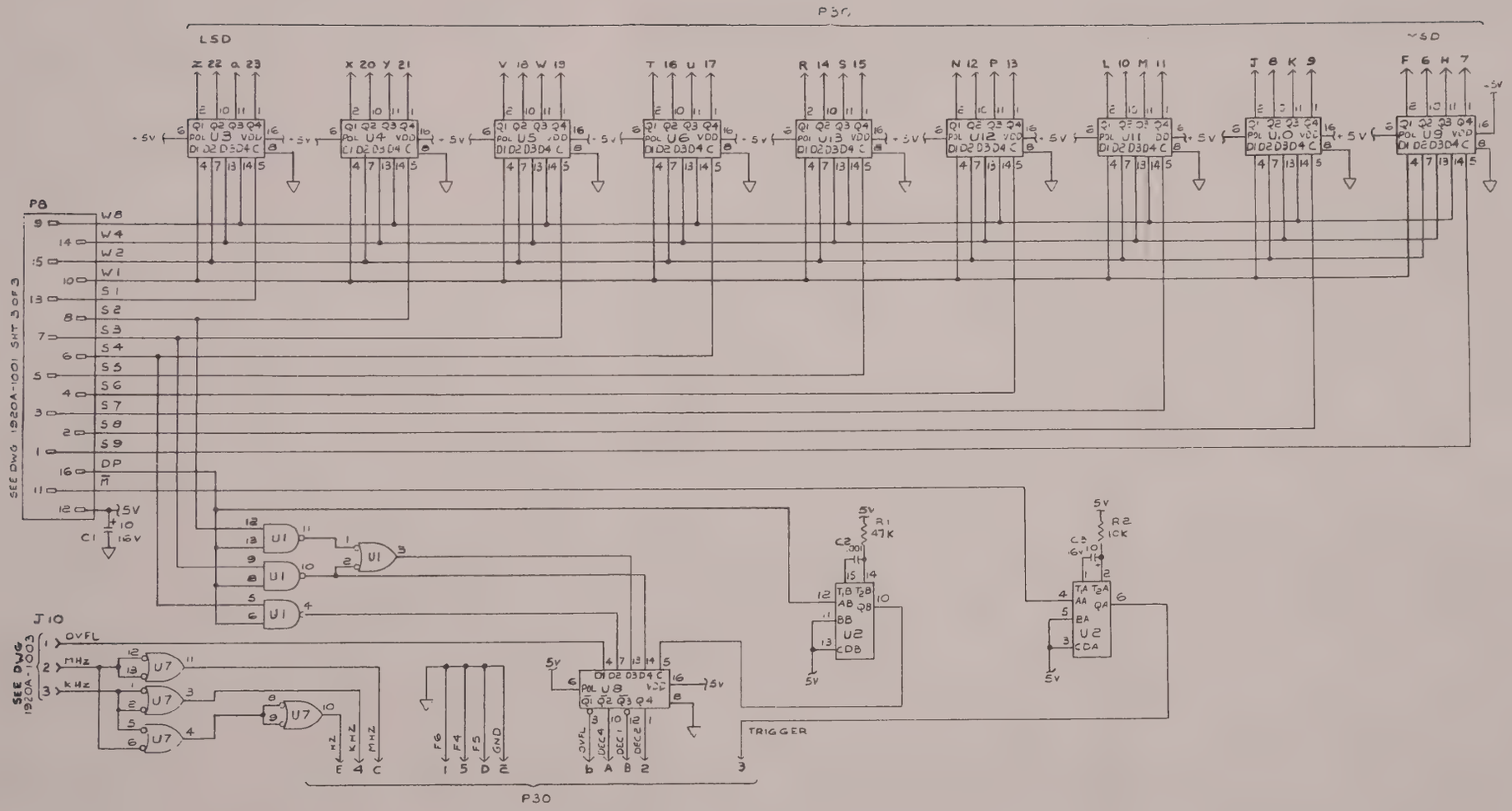
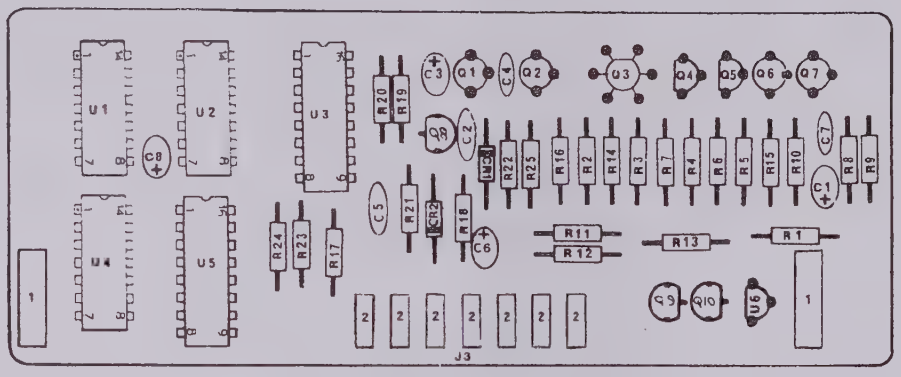


Figure 8-7. Data Output Unit PCB Assembly



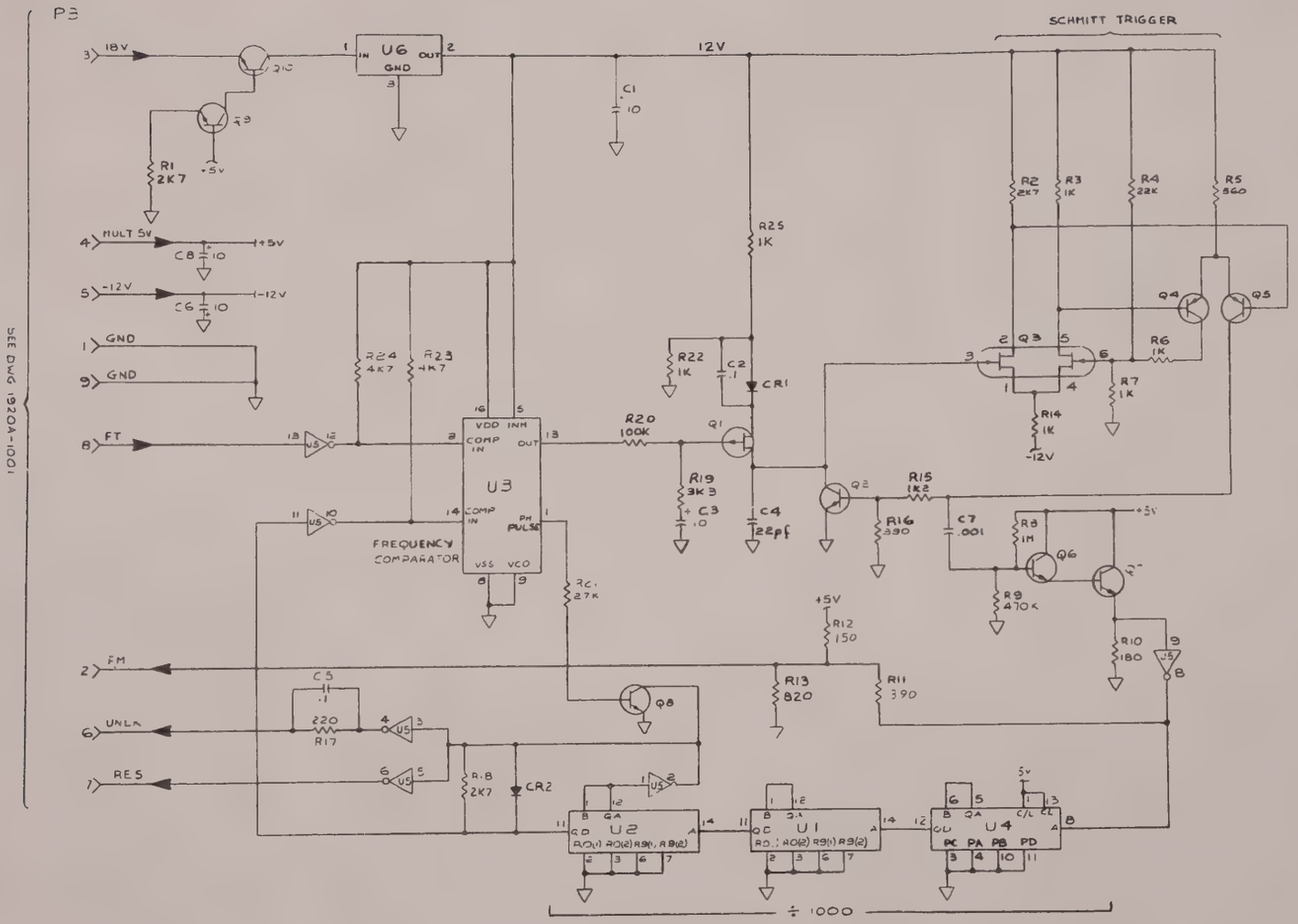
1920A-1008

Figure 8-7. Data Output Unit PCB Assembly (cont)



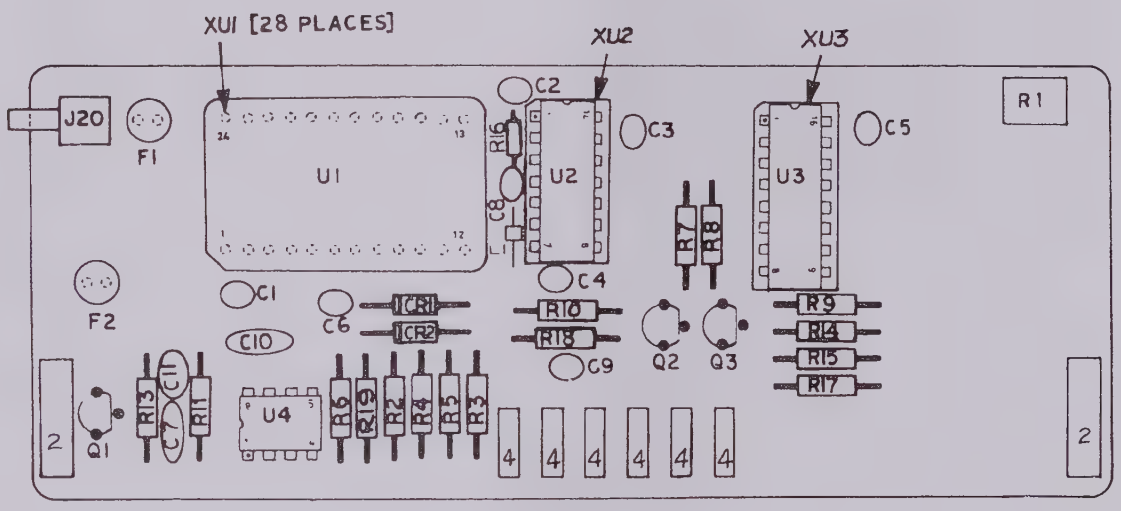
1920A-1206

Figure 8-8. Resolution Multiplier PCB Assembly



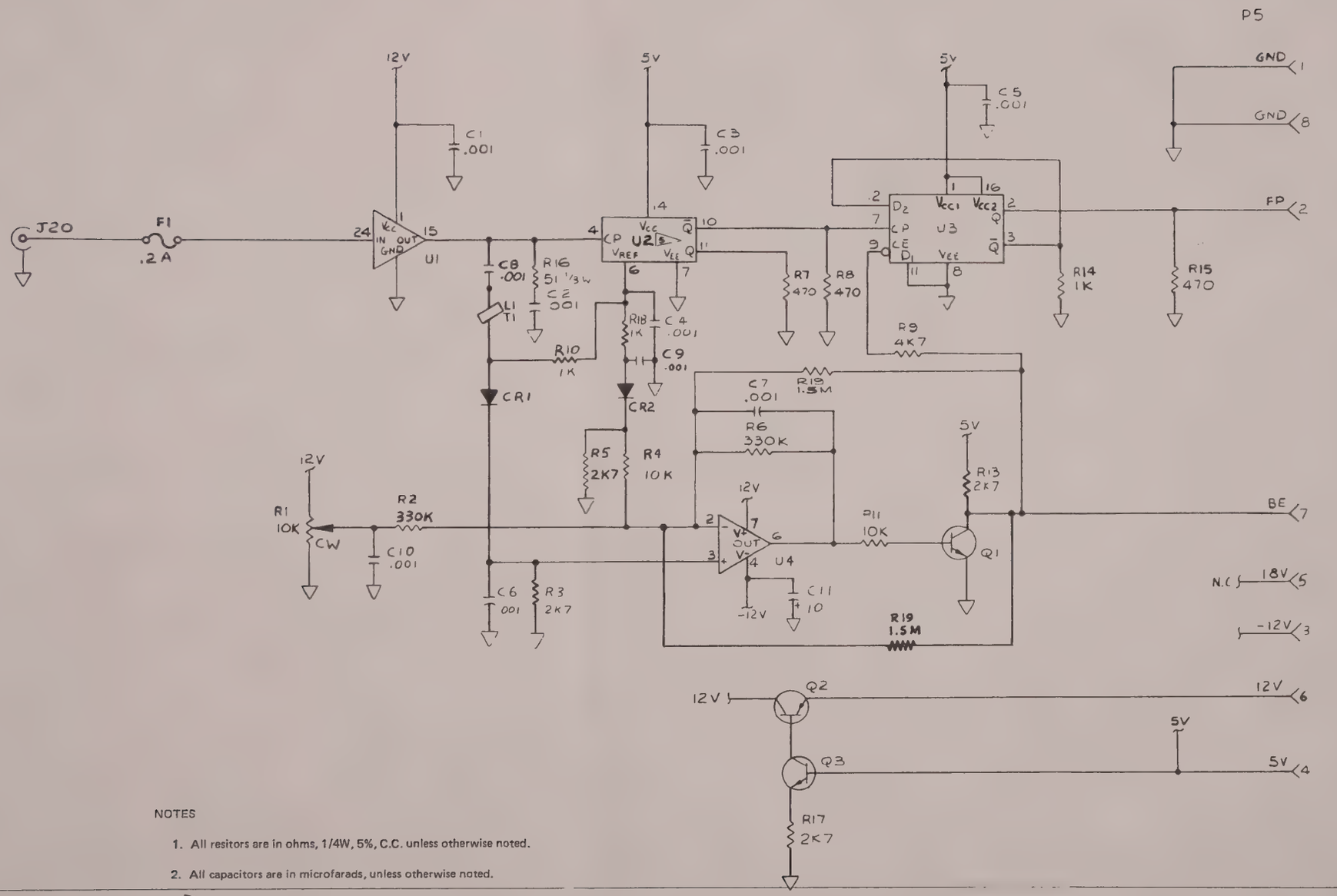
1920A-1006

Figure 8-8. Resolution Multiplier PCB Assembly (cont)



1953A-1227

Figure 8-9. 1 GHz Prescaler PCB Assembly



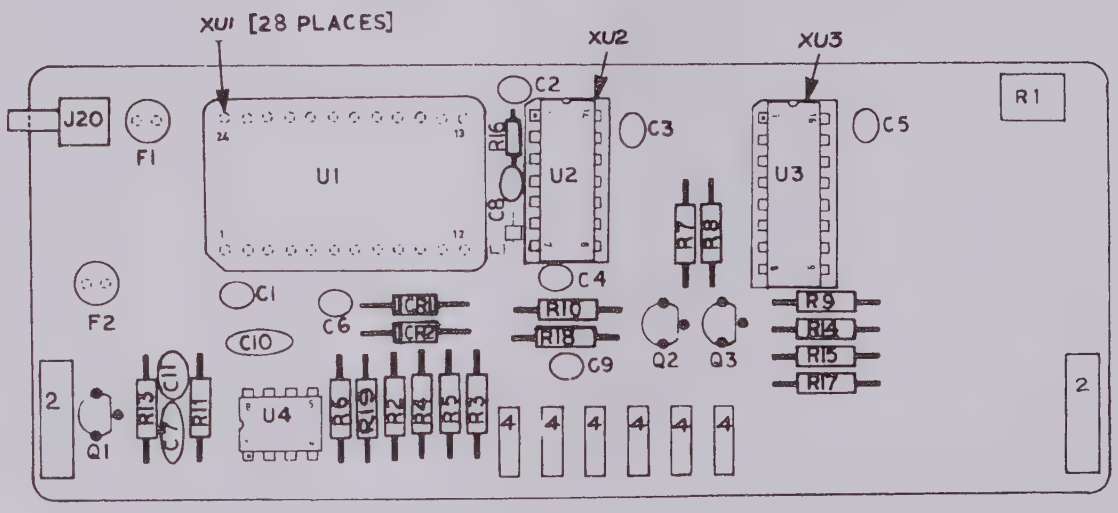
NOTES

1. All resitors are in ohms, 1/4W, 5%, C.C. unless otherwise noted.
2. All capacitors are in microfarads, unless otherwise noted.

5 U2 selected for 1.25 GHz Prescaler only

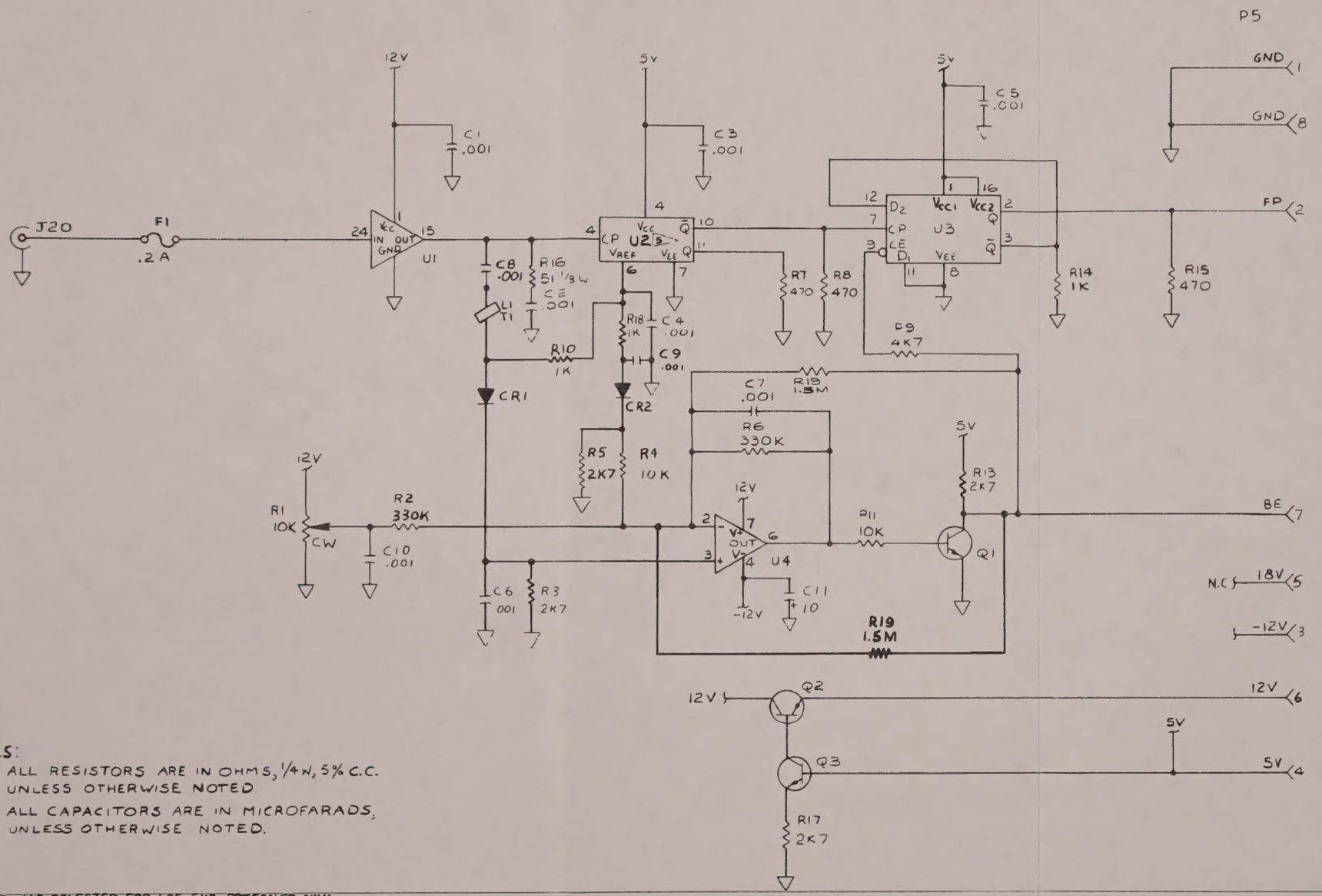
1953A-1027

Figure 8-9. 1 GHz Prescaler PCB Assembly (cont)



1953A-1228

Figure 8-10. 1.25 GHz Prescaler PCB Assembly



NOTES:

1. ALL RESISTORS ARE IN OHMS, 1/4 W, 5% C.C. UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS ARE IN MICROFARADS, UNLESS OTHERWISE NOTED.

(5) U2 SELECTED FOR 1.25 GHz PRESCALER ONLY

1953A-1028

Figure 8-10. 1.25 GHz Prescaler PCB Assembly (cont)

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